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CONTENTS

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The Generic Concept

By Leonhard Stejneger and Thomas Barbour

SOME days ago the junior author wrote the senior author a letter just on the chance that his arrow would strike a pot of gold. It did just this and the reply, which this letter elicited, is the best succinct statement of the real purpose for which generic names are to be established and used that perhaps ever has appeared. The tendency to assume that similarity justifies the assumption of a monophyletic origin is distasteful to many of the older naturalists especially when this probability is counterindicated by some other factor. A good example of this trend is the usage now common in America to separate one group of racers under the name of *Masticophis* and another under the name of *Coluber*. No such division can be very convincing until a careful study of Old World as well as New World forms has been made. This applies to the situation in *Natrix* as well. As yet material for such general revisions is not available and until it is it seems to us premature to indulge in promiscuous generic splitting, or by the same token promiscuous lumping.

Exceptions prove every rule and *Opheodrys* and *Liopeltis,* long considered to be really valid genera, are now by more or less universal agreement united since intermediate forms occur in China and monophyletic origin is strongly to be presumed for groups of species coming from eastern Asia and eastern North America. Abundant evidence confirming this assumption is to be found among animals and much more still among plants.

October 22, 1940

Doctor Leonhard Stejneger
United States National Museum
Washington, D. C.

Dear L. S.

Several colleagues are trying to make me believe that the Old World pit vipers, which we have called *Trimeresurus,* and the New World species, *Bothrops,* are all congeneric. I have always had a feeling that they were better kept apart, most of the Old World species having prehensile tails which is not the case with most of the New World forms. *Bothrops schlegelii,* of course, has a completely prehensile tail and I suspect *B. nigroviridis* has also.

I have been cudgelling my mind to think of some other character which would set off the groups of species, one from the other, but I can't do it and yet the distribution does not suggest a common origin for the whole lot. On the chance that you may have been thinking along the same lines I am dropping you this line of inquiry.

Sincerely

(Signed) T. B.

To elaborate the pit viper remarks it may be noted that *Trimeresurus flavoviridis* of Riu Kiu has a long, straight tail and looks suspiciously *Bothrops*-like in other respects. So there may be two genera each with representations in the Old World and the New but this we do not really know yet. Not improbably studies of the properties of the venoms may throw light on the subject.

October 24, 1940.

Dr. Thomas Barbour,
Museum of Comparative Zoölogy
Cambridge, Massachusetts

Dear T. B.:

With regard to *Bothrops* my own standpoint is about the same as with *Natrix:* I don't want to change the present current nomenclature until someone makes a thorough study of all the important structures in practically all the groups of species (not only tails and scales and intromittent organs) demonstrating the amount and quality of their relationships. What is the use of shifting about from one uncertainty to another? The *Trimeresurus-Bothrops* complex is certainly not as homogeneous as the *Agkistrodon.* I don't believe that the nomenclature should be made the football of a game of venting individual theories of origin and distribution in paleogean times. The object of Nomenclature is *primarily* to be a convenience to help one talking of these creatures and the present one is certainly helpful and convenient in that it tells you whether the snake I am talking about is an old world or a new world form. This help is particularly useful in groups of large numbers of species. It is time enough to make a change when it is convincingly proved that the group is strictly monophyletic; in the meantime the present usage is preferable to such a nomenclature as "American *Trimeresurus* with non-prehensile tail," "Asiatic species with prehensile tail," "American species with prehensile tail" etc.

And this brings me to the question of a "stable" nomenclature. It does not seem as if a majority of taxonomists realize that "stability" is obtainable practically only in the "species" names (apart from the juggling with binominals and trinominals). In genera the best we can hope for is that the oldest name be used for the varying concepts. "Genera" are conveniences and must remain so for quite a long time to come. Taxonomists may perhaps eventually succeed in unraveling the true relationships of the various groups of "Kreise," but the varying attempts to do so need not be portrayed in a wobbling nomenclature. The great majority of zoologists, professional and otherwise, have scant chance to investigate the intricacies of group relationships and must of necessity accept the dictum of some specialist, and there is where the great usefulness of the check lists is apparent in "stabilizing" generic nomenclature—or at least in checking premature and partial, not to say fashionable, "improvements."

Yours,
(Signed) L. S.

U. S. National Museum, Washington, D.C., and Museum of Comparative Zoology, Cambridge, Massachusetts.

The Determination of the Number of Eggs in Ovaries of Brook Trout (*Salvelinus fontinalis*)

By Vadim D. Vladykov and Vianney Legendre

THE published records on the fecundity of brook trout (*Salvelinus fontinalis*) are rather limited. Kendall (1914: 85)[1], as well as Embody and Hayford (1925: 140–142) gave some information on fish artificially reared, while Titcomb (1897: 84), Ricker (1932: 103–105) and Stobie

[1] Kendall took his data from a "MANUAL of FISH CULTURE" (1900: 33).

(1938: 102) presented a few data on wild stock. However, the present knowledge of this matter can be summarized by the following passage, taken from Needham (1938: 32): "we do not know just how many eggs are produced on the average in wild fish."

During the survey of the Laurentides Park in the province of Quebec, the present authors had collected a large number of ripe trout. A detailed account of this study will be given later. The present note will only deal with a description of a rapid and sufficiently accurate method for the determination of the number of eggs without actually counting them.

There are several authors who described the procedure of determining the fecundity in fishes with numerous, but small eggs. Raitt (1933) worked on haddock, Sokolov (1933) on carp, and Stone (1937) on cisco, to mention a few. These methods are not applicable to brook trout, as this species produces a small number of eggs which are large in size (around 4 millimeters).

Seventy-seven ovaries, with well-developed eggs, ranging from 2 to 4 millimeters in diameter, were examined for this study. The collected gonads were preserved, for a period varying from a few months to one year, in 5 per cent formalin. The ovaries containing eggs smaller than 2 millimeters in diameter, are not considered here.

The procedure was as follows:

1. The ovaries were placed on cheese cloth to remove excess moisture.

2. Then they were transferred to a graduated cylinder and the total volume determined.

3. The diameters of twenty eggs from each ovary were measured to the nearest 0.5 millimeter by placing the eggs in a row on a measuring board made in the form of a trough with triangular cross-section.

4. From the average diameter, d, of forty eggs, the volume v of one egg[2] was calculated, according to the formulae: $v=\frac{1}{6}\pi d^3$. For practical purposes, this formula can be simplified to $v=0.52\ d^3$.

The diameters d and d^3 were expressed in millimeters, to two decimal places.

5. The number of eggs were determined by using the formula $N=\frac{V}{v\,K}$, where N is the total number of eggs in both ovaries; V represents the entire volume of the two ovaries, eggs and ovarian tissue included; v corresponds to the volume of a single egg. K is a coefficient giving the ratio between the total volume of the eggs only and the volume of the ovaries. The value of K was found to be equal to 1.28.

In the table below, the fecundity as estimated by the volumetric method and the fecundity as determined by actual egg counts are compared. The average error for 77 ovaries was 0.5 per cent.

[2] It was assumed, that the shape of an egg is a sphere.

Comparison of Actual and Estimated Fecundities

Length—Class[3]		Number of fish	Average number of eggs		Per cent error
Inches	Millimeters		Counted	Estimated $\left[\frac{V}{v \times 1.28}\right]$	
5.0- 5.9	125–149	4	131	122	−6.9
6.0- 6.9	150–174	14	177	170	−4.0
7.0- 7.9	175–199	10	206	197	−4.4
8.0- 8.9	200–224	11	280	278	−0.7
9.0- 9.9	225–249	14	362	360	−0.5
10.0–10.9	250–274	13	505	522	+3.4
11.0–11.9	275–299	3	732	765	+4.5
12.0–12.9	300–329	6	970	972	+0.2
13.0–13.9	330–354	1	1,691	1,666	−1.5
14.0–14.9	355–379	1	1,247	1,217	−2.4

[3] The length was measured from the tip of the snout of the extremity to the middle caudal rays.

The difference between estimated fecundity and actual counts is due principally to the presence of ovarian tissue. For eggs smaller than 2 millimeters in diameter, the amount of ovarian tissue is proportionally greater, hence K increases also, being equal to 1.32. The influence of water or preservative which adheres to the eggs, may be considered to be negligible.

It would be very interesting to apply the above described formula to other species of Salmonidae.

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Station Biologique du Parc des Laurentides, Institut de Zoologie, Université de Montréal, Montréal, Canada.

Notes on the Dissemination of Shad, *Alosa sapidissima* (Wilson), along the Pacific Coast of North America

By Arthur D. Welander

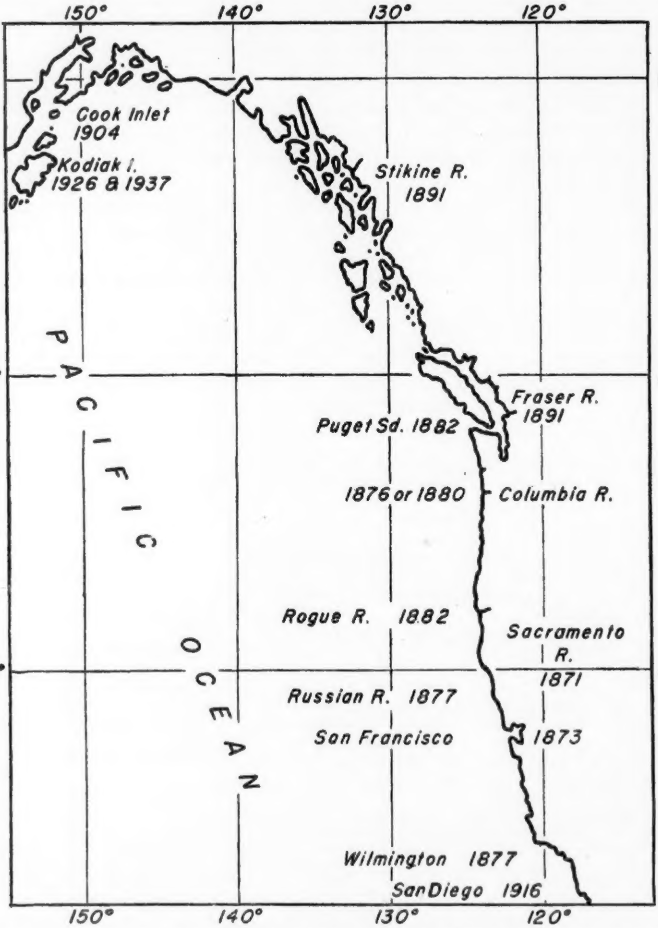
SINCE their introduction into California's Sacramento River in 1871 by the California Fish and Game Commission the spread and the increase of the shad, *Alosa sapidissima* (Wilson), along the Pacific Coast of North America has been one of the most remarkable in all the cases of introduced species. To date, according to the available records, the shad has become adapted to coastal waters from San Diego Bay, California, northward and westward to Karluk, Kodiak Island, Alaska. This range covers approximately 27° of latitude and about 3,000 miles of coastline, as compared with its native range of approximately 21° of latitude and about 3,000 miles of coastline from Alabama northward to the St. Lawrence River (Leim, 1924: 165). Although the records can only serve to indicate when shad were first seen in the various localities and cannot represent the true time of arrival, they may serve to indicate roughly the speed of dispersal along the coast. Brief accounts of the introduction of shad in 1871 into the Sacramento River, and the Columbia River, with subsequent reports of mature fish disseminating along the coast, are tabulated in chronological order as follows:

Date	Locality	Authority
1871	Shad fry were first introduced into Sacramento R.	Smith, 1896:405
1873	First appearance of mature shad in Sacramento R.	Smith, 1896:407
1874	Large numbers of mature shad in Sacramento R.	Nidever, 1916:61
1876	Doubtful record of mature shad taken in Columbia R.	Smith, 1896:408
1876	Shad distributed from Vancouver Is., B.C. to Golden Gate, Cal.	McDonald, 1891:LI
1877	Mature shad numerous at Wilmington, Calif. and in the Russian River 42 miles north of San Francisco	Smith 1896:408
1880	Mature shad taken in Columbia R.	Jordan, 1916:152
1882	Mature shad taken in rivers of Southern Oregon	Smith, 1896:408
1882	One mature shad taken in Puget Sound	Swan, 1883:152
1883	Mature shad taken near Ellensburg, Wash.	Finley, 1884:88
1885	Shad fry were first planted in Columbia R. drainage system	Smith, 1896:407
1891	Mature shad taken in Fraser R., B.C. and Stikine R., S.E. Alaska	Smith, 1896:409
1892	Mature shad taken in Rivers Inlet, B.C.	Smith & Kendall, 1898:174
1904	Mature shad taken at Kasilof on Cook Inlet, Alaska	Everman & Goldsborough, 1907:234
1916	Mature shad taken near San Diego, Calif.	Starks, 1918:63
1926	Mature shad taken at Karluk on Kodiak Is., Alaska	H. B. Holmes of U.S. Bur. Fish.

In 1926, as tabulated above, the most westerly record of shad was taken in June at Karluk on Kodiak Island, Alaska, by H. B. Holmes of the U. S. Bureau of Fisheries. The specimen is preserved in the Natural History Museum, Stanford University. No note was made of this record in the literature.

In 1937, eleven years later, in almost the same locality, another shad was taken during the summer by Allen C. DeLacy of the United States Bureau of Fisheries at Uyak Bay, Kodiak Island, Alaska. This specimen

was 477 mm. in standard length, and is now in the collection of fishes at the University of Washington, Seattle.



Map indicating the distribution of shad along the northwest coast of North America with dates of their first appearances at the various localities.

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Notes on the Food Habits and Parasites of the Stickleback, *Gasterosteus aculeatus* (Linnaeus), in the Sacramento River, California

By Merle H. Markley[1]

IN late October, 1938, a collection of 500 sticklebacks was made in the Sacramento River near Anderson, California, and in the following paper the food habits and internal parasites of the common three spined stickleback, *Gasterosteus aculeatus* (Linnaeus), are discussed.

[1] For identification and information on the parasites, I am indebted to Dr. Harold J. Kirby, Jr., Associate Professor of Zoology, University of California, Berkeley, California, and to Dr. John E. Guberlet, Professor of Zoology, University of Washington, Seattle, Washington.

The fish were obtained with a small hand seine from shallow isolated pools along the edge of the stream. Since they had been confined in small pools for several days previous to the time of their capture, the analysis which is made of their stomach contents may not give a true index of their feeding habits. Conditions in the open waters of the main channel would at times be different from those under which the fish were captured.

Comparative lengths of parasitized and nonparasitized fish were recorded, and in the text standard lengths have been used.

The complete contents of the stomachs were examined with the aid of a microscope. In some instances only fragments of insects or other small invertebrates could be found, and such material was listed under unidentified animal matter. The percentages given indicate estimates by volume only.

Sticklebacks found in Pacific Coast streams are quite commonly parasitized, many of them with organisms inhabiting the abdominal cavity. Such parasites secured from the present material belong to the genus *Schistocephalus*, probably the species *Schistocephalus solidus* (Muller), syn. *S. gasterostei* (Fabricus). The adult cestode, a worm 3 to 10 cm. long, is found in the intestinal tract of aquatic birds. The primary larval stage develops in a copepod, and the stickleback serves as a second intermediate host. The worms found in the fish, also larval forms, are called plerocercoids. The fish becomes infected by ingesting copepods, and aquatic birds in turn become infected by eating the stickleback. The second larval stage does not seem to attack other fishes commonly.

Of the 500 sticklebacks examined, 195, or 39 per cent, were found to contain parasites. Individual fish contained from one to as many as 8 larvae. From 150 parasitized fish, 334 larvae were taken, an average of 2.29 parasites in each infected fish. Presence of larvae in the fish caused the abdomen to protrude noticeably in most cases.

To determine if a relation existed between parasitism and the size of the fish, comparative lengths of parasitized and non-parasitized fish were recorded. The parasitized specimens were found to be the larger fish, averaging 40.13 mm. in length, while those specimens free from parasites averaged only 35.37 mm. in length. It is hardly conceivable that infection by parasites could result in increased growth. It is more likely that the parasitized fish represent a more mature age class, and that many of the smaller fish, now immature, may become parasitized later.

The worm parasites of the European sticklebacks are better known than those of the American species, and should be suggestive of what to expect here. A tapeworm, *Schistocephalus gasterostei* (Fabricus) is recorded from *Gasterosteus*, and is figured by Pratt (1916: 194). Another tapeworm, *Proteocephalus fillicallis* (Reed), is also recorded from *Gasterosteus* by Leidy (1904: 188) and La Rue (1914: 38), and a parasitic entomostracan, *Lerneae*, has been taken on sticklebacks in Europe by Wilson (1917: 195). A sporozoan, *Henneguya*, was taken from *Gasterosteus* by Mavor and Strasser (1916: 680). The limited amount of information available on the subject is evidence of the neglect of this common species.

An analysis of the stomach contents of 93 sticklebacks showed that nearly 70 per cent of the stomachs examined were completely lacking in food material. In the stomachs which did contain food, the diet was, for the most part, similar to that of the brook stickleback, *Eucalia inconstans*, being composed of insects and other small invertebrates. Many of the fish had been feeding upon green algae, which in spite of its frequent occurrence in the diet, formed only a very small portion of the total volume of food.

An estimate of the percentages by volume of the principal items found in the diet of the stickleback is as follows: Coleoptera larvae, 11.10%; Diptera adults, 37.00%; Hyallela adults, 26.00%; Green algae, 3.70%; Unidentified animal matter, 22.20%.

The Diptera adults were mostly midges, *Chironomus* sp., while the Coleoptera larvae were the immature forms of the riffle beetle, *Elmis* sp. It seems likely that the stickleback's food preferences would place it in direct competition with some of the game fishes and thus affect the available food supply. However, the stickleback seems to prefer the warmer, slow-flowing valley streams, while the trout have a preference for the cool, rapid-flowing mountain streams. Bass, which often inhabit this warm water area, may feed upon the sticklebacks and thus make up for any loss of food through competition.

Summary

It is apparent that the stickleback is of considerable importance as an intermediate host for the larval tapeworm *Schistocephalus solidus* (Muller), 39 per cent of the fish examined being infected. The stickleback's food habits are, for the most part, insectivorous, but some green algae is eaten. It is not a food competitor of trout because it occupies a different stream environment from that of the latter species. The food habits of the common three spined stickleback were found to be very similar to those of the brook stickleback, *Eucalia inconstans* (Kirtland).

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Status of the Catostomid Fish, *Carpiodes carpio elongatus* Meek

By Carl L. Hubbs and John D. Black

In the course of our respective researches on the fishes of northeastern Mexico and of Arkansas, we have had occasion to investigate the status of the southwestern representative of the carp-sucker, *Carpiodes carpio* (Rafinesque). During the preparation of the paper we have examined all of the specimens of this species in the University of Michigan Museum of Zoology (U.M.M.Z.) and some critical material in the United States National Museum (U.S.N.M.). Earlier the senior author studied pertinent material in the Museum of Comparative Zoology and Field Museum of Natural History. Our thanks are due the authorities of these institutions.

It is concluded that *Carpiodes carpio* is represented in the Río Grande system, and in other Gulf tributaries from the Río Soto la Marina in northeastern Mexico northeastward through Texas, and probably to the lower Mississippi, by a form which seems to be only subspecifically differentiated. This subspecies is here designated *Carpiodes carpio elongatus* Meek, the slender carpsucker. The wide-spread northern and western form, which may be called the common carp-sucker, will therefore take the name *Carpiodes carpio carpio* (Rafinesque).

The status and distinctive characters of *Carpiodes carpio* proper have been satisfactorily treated by Forbes and Richardson (1909 and 1920: 75–77, Fig. 17) and Hubbs (1930: 14–15), and need not be reviewed. The published treatments of the southwestern form, however, are replete with confusion, as indicated in the following synonymy.

Carpiodes carpio elongatus Meek

Carpiodes tumidus (misidentification).—Jordan, 1878: 405 (in part; *C. grayi* confounded).

Carpiodes velifer tumidus.—Evermann and Kendall, 1894: 77, 80, 82, 85, 89, 91, 97 (in part; *C. grayi* confused; Cope's San Ildefonso specimens of "*C. grayi*," collected between 1871 to 1874, wrongly stated to be the types of *C. grayi* Cope, 1870: 482–483, and 1877: 482–483, with supplementary "Notes to Second Edition"; Río Lampasas at Belton and Río Colorado at Austin, Texas).

Carpiodes cyprinus (misidentification).—Jordan, 1878: 666 (in part; *C. grayi* confounded).

Carpiodes grayi (presumed misidentification, since the original *C. grayi* appears to be a synonym of *C. carpio carpio*).—Cope, in Cope and Yarrow, 1875: 681 (San Ildefonso, on Río Grande, New Mexico). Fowler, 1904: 242–243 (Del Rio, Texas).

Ictiobus velifer (misidentification).—Jordan and Gilbert, 1886: 18, 20 (characters; Rio Lampasas at Belton and Río Colorado at Austin, Texas).

Ictiobus carpio (misidentification as to subspecies).—Jordan and Gilbert, 1886: 20 (characters; Río Colorado at Austin, Texas).

Carpiodes carpio.—Evermann and Kendall, 1894: 80, 82, 91, 97 (Río Colorado at Austin and Long Lake near Magnolia Point, Texas).

Carpiodes elongatus.—Meek, 1904: xxxi, xxxiv–xxxv, 26, 28–29, fig. 5 (original description; San Juan, Montemorelos, Linares, and La Cruz, Mexico). Fowler, 1913: 47 (reidentification of specimens from Del Rio, Texas, previously reported as *C. grayi*).

Ictiobus elongatus.—Regan, 1907: 144 (characters; range).

Carpiodes microstomus.—Meek, 1904: xxxi, 26–28, fig. 4 (original description; Santa Rosalia and Jimenez, Mexico).

Ictiobus microstomus.—Regan, 1907: 144 (characters; range).

As indicated above in the synonymy, this *Carpiodes* has been confused with *Carpiodes tumidus* Girard, which, as stated by Hubbs (1930: 12–13), is a synonym of *Ictiobus bubalus*. It will be shown by Hubbs and Gordon that the Mexican specimens reported by several authors as *Carpiodes* or *Ictiobus tumidus* are also referable to *Ictiobus*.

Two available names, *Carpiodes elongatus* and *C. microstomus*, have been applied to this form. An examination of type specimens of these nominal species (Table 1) fails to verify the alleged distinctions in depth of body and length of head, pointed out by Meek (1904: 26), or to indicate other characters by which two forms might be distinguished. The specimens from Santa Rosalia have the head a little more tumid and wider and the eye slightly smaller than in the other types, but the systematic significance of this difference is very doubtful. We regard *C. elongatus* and *C. microstomus* as synonymous, and since the names are of identical date, select one name (*elongatus*) as the valid appellation for the combined unit.

TABLE 1

CHARACTERS TAKEN FROM TYPES OF *Carpiodes elongatus* AND *C. microstomus*

Nominal species	Type	Locality	Head	Depth	Inter-orbital	Dorsal rays	Scales
C. elongatus.....	Holotype	Linares	4.15	3.3	2.5	24	35
C. elongatus.....	Paratype	Linares	3.95	3.1	2.5	25	37
C. elongatus.....	Paratype	Linares	3.95	3.0	2.4	25	35
C. elongatus.....	Paratype	San Juan	4.0	3.0	2.4	22	37
C. microstomus..	Paratype	Sta. Rosalia	4.15	3.3	2.3	24	37
C. microstomus..	Paratype	Sta. Rosalia	4.15	3.0	2.3	24	37

Meek's type figure of *Carpiodes elongatus* is a fairly good representation of this sucker, but his illustration for *C. microstomus* is very poor.

As in *Carpiodes carpio carpio* the mouth of *C. c. elongatus* is usually located far backward, so that more than half its length lies behind the vertical from the internarial flap. The opercle is strongly striate. The scales are not very closely imbricated. The body is slender. The sharp but low anterior lobe of the dorsal fin is much shorter than the dorsal base. These resemblances are fundamental ones in the taxonomy of *Carpiodes*.

The southwestern form differs rather consistently from typical *carpio* in the following respects: The semitubercular process at the tip of the lower jaw, moderately diagnostic of northern *carpio*, is lacking or weakly developed. The gape tends to be more semi-circular, less four-sided. Typically the anterior part of the back is more arched. The cross-hatching

that outlines the scale pockets is usually more conspicuous, providing a means for the identification of most adult specimens. Perhaps the most striking and certainly the most easily measured differences involve the depth of the body, the length of the caudal peduncle and the length of the dorsal base. *C. c. elongatus* is the more attenuate, especially toward the caudal fin, and the dorsal fin on the average is shorter. The length of the dorsal base when projected forward usually falls far back of the eye in *elongatus* but reaches almost to or even beyond the back edge of the eye in *C. c. carpio*. However, the individual variation in this measurement is so great that no statistical analysis is attempted.

The differences in the form of the body and in the length of the dorsal fin are well indicated by two ratios: the distance between the end of the dorsal base and the middle of the caudal base, measured into the basal length of the dorsal fin (Table 2A); and the length of the dorsal base, stepped into the standard length (Table 2B). Except for certain small groups purposefully kept separate, the overlap in the measurements of Table 2 is due much more to individual than to regional variation. Although referable to *C. c. carpio* the fish from the Arkansas and Red rivers seem to approach *C. c. elongatus*, not only in the ratios given in Table 2 but also in other characters. Similarly the material of *elongatus* from the coastal streams of Texas appears to grade toward typical *carpio*. Complete intergradation will probably be demonstrated when adequate material is available from Louisiana and the adjacent parts of the bordering states.

Two cotypes (U.S.N.M. 178) of *Carpiodes damalis* Girard, from Milk River, Montana, are included among the specimens of *Carpiodes c. carpio* measured for Table 2. In these types the distance between the dorsal and caudal bases enters the dorsal base 2.5 times, and the dorsal base measures 2.3 to 2.4 times in the standard length.

Carpiodes carpio elongatus is probably wide-spread through the Soto la Marina, San Fernando, San Juan, and Sabinas river systems of northeastern Mexico (as will be shown in a forthcoming report by Carl L. Hubbs and Myron Gordon). It proves to be common in the coastal streams of Texas as well as in the Río Grande system of Texas and New Mexico. The northernmost records are for 2 half-grown (U.M.M.Z. 66183) collected by T. D. A. Cockerell at Hondo in the Pecos River system of New Mexico, and for 2 young (U.M.M.Z. 109496) seined by Joseph R. Bailey in the Mississippi River near the Louisiana-Arkansas state line (some doubt pertains to the identification of these young specimens and hence to the inclusion of the lower Mississippi in the range of *elongatus*). Measurements for these 2 series are given separately in Table 2.

In the fish collection of the University of Michigan there are many specimens of *Carpiodes carpio elongatus* from several stream systems in Texas and from the Río Grande and its tributaries in New Mexico. Some of these were collected by R. T. Richey in Little Brazos River 10 miles west of Bryan, and in a borrow pit 4 miles west of Bryan, Texas. Kelshaw Bonham and students recently collected specimens in Eagle Lake, Colorado County, and in Clear Creek, a tributary of Navasota River east of Kurten, Texas. Others were seined by Carl L. Hubbs and family in the following streams in Texas: South Bosque River 10 miles south-

Table 2

Proportionate Measurements in *Carpiodes carpio*

A.—Distance between End of Dorsal Base and Middle of Caudal Base, Measured into Basal Length of Dorsal Fin

	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	No.	Ave.
Carpiodes carpio carpio																					
Tennessee and Ohio river systems									2			4	1		2	1	1	1		12	2.41
Missouri River system										2	5	12	4	3	3	3	2	1	1	36	2.43
Mississippi River and minor tributaries, northern Arkansas to Wisconsin						1	1			1	3	5	8	6	2	2	4	1	2	36	2.46
Arkansas and Red river systems						1	8	4	6	9	12	15	11	8	7	3	3			87	2.26
Carpiodes carpio elongatus																					
Mississippi River, near Arkansas-Louisiana line						2														2	1.70
Coastal streams of Texas						4	10		3											17	1.81
Tributaries of Río Grande, Texas	1	1	14	10	10	3	2													41	1.41
Pecos River system, New Mexico								2												2	1.90
Río Grande and tributaries, New Mexico				2	8	5														15	1.62
Río Salado, near Músquiz, Mexico					1															1	1.60
Totals: *Carpiodes c. carpio*						2	9	4	8	12	20	36	24	17	14	9	10	3	3	171	2.35
Carpiodes c. elongatus	1	1	14	12	19	14	12	2	3											78	1.61

B.—Length of Dorsal Base, Stepped into the Standard Length

	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	No.	Ave.
Carpiodes carpio carpio															
Tennessee and Ohio river systems		1	3	4	1	1	2							12	2.63
Missouri River system	1	9	14	7	2	2		1						36	2.53
Mississippi River and minor tributaries, northern Arkansas to Wisconsin	2	14	8	9	3									36	2.49
Arkansas and Red river systems		10	17	28	25	3	3	1						87	2.61
Carpiodes carpio elongatus															
Mississippi River, near Arkansas-Louisiana line								2						2	3.00
Coastal streams of Texas				1	3	5	6	1	1					17	2.83
Tributaries of Río Grande, Texas					1	1	8	11	2	6	8	3	1	41	3.10
Pecos River system, New Mexico					1	1								2	2.75
Río Grande and tributaries, New Mexico					1			5	1	2	4	1	1	15	3.15
Río Salado, near Músquiz, Mexico					1									1	2.70
Totals: *Carpiodes c. carpio*	3	34	42	48	31	6	5	2						171	2.57
Carpiodes c. elongatus				1	7	7	14	19	4	8	12	4	2	78	3.04

west of Waco, Hog Creek west and south of Waco, Waco Creek on Baylor University campus at Waco, Pinto Creek west of Brackettville, and Devil River on U. S. Highway 90 in Val Verde County. Two young (only 15 and 16 mm. in standard length), showing to exaggeration the slender form, short head, snubby snout, and small eye of *elongatus*, were taken by E. P. Creaser and Myron Gordon in Arroyo Chacón at Laredo, Texas. Numerous large to small young were obtained by Leo T. Murray of Baylor University in Tornillo and Terlingua creeks, Brewster County, Texas. Still other examples are at hand, from Río Grande near Las Cruces, and from a borrow pit near this river, 2 miles south of Alameda, both in New Mexico. Samples of almost all of these series were measured for Table 2.

Summary

Carpiodes elongatus and *C. microstomus* Meek are synonymized. *Carpiodes carpio elongatus* is the southwestern representative of *C. c. carpio*. It ranges from northeastern México through the Río Grande system of New Mexico and Texas to the coastal streams of eastern Texas, probably to the lower Mississippi River.

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Some Deep Sea Fishes from the North Atlantic[1]

By William C. Schroeder

DURING the summers of 1937, 1938 and 1939, a few Blake-trawl hauls were made on bottom, in 640–2030 fathoms, by the research vessel "Atlantis" of the Woods Hole Oceanographic Institution, off the southern slope of Georges Bank during the course of submarine geology investigations. Mr. William E. Schevill was in charge of these hauls. Certain of the fishes proved to be comparatively rare or unknown in the western North Atlantic. All the fish caught, together with a few taken by "Atlantis" in 1936, and one specimen received from a fishing boat that same year, are included herewith.

List of Species

Alepocephalidae

Alepocephalus agassizii Goode and Bean, 1883

Alepocephalus agassizii Goode and Bean, Bull. Mus. Comp. Zool., 10, 1883: 218.

Depth 4.5 to 4.8; head 2.7 to 3.1; eye (horizontal) 3.6 to 4.2; snout 4 to 4.2; interorbital (bone) 6.5 to 7.8; D. 15 or 16; A. 15 to 17; V. 6 or 7; P. 12; scales 95 to 110. A single row of small, rather close set, curved teeth on the palatines, premaxillary and mandible. The maxillary, vomer and tongue are toothless.

Koefoed (1932: 36) gives an account, with detailed measurements, of five specimens taken in the eastern North Atlantic. For these the dorsal rays are given as 16–17, anal 17–18, pectoral 10–12 and scales about 80–90. The scale counts (95–110) on the "Atlantis" specimens were made from the upper angle of the voluminous gill cover to the base of the caudal. Nearly all of the other proportions given by Koefoed were in close agreement with the "Atlantis" specimens. The type of this species is in the collection of the M.C.Z. but is badly mutilated. Dr. Leonard Schultz kindly sent me an "Albatross" specimen from the U. S. National Museum collection for comparison. Color black.

Three specimens, 338, 473 and 642 mm. in total length were taken by "Atlantis" in three hauls made within a few miles of Lat. 40° 04′ N., Long. 68° 05′ W., in 1100–1250 fathoms, with a Blake-trawl fishing on bottom. These fish were brought up in very good condition.

Caribbean Sea; North Atlantic Ocean, on the western side from Lat. 36° 30′ N., Long. 74° 33′ W., to Lat. 41° 53′ N., Long. 65° 35′ W.; on the eastern side, off the southwest coast of Iceland and west of Great Britain near Long 12° W. in a depth range of 523–1250 fathoms.

Stomiatidae

Stomias boa ferox Reinhardt, 1842

A specimen 303 mm. long, to caudal base, was taken by a fishing trawler in Lat. 42° 10′ N., Long. 67° 05′ W., in about 100 fathoms, January 20,

[1] Contribution No. 283 from the Woods Hole Oceanographic Institution.

1936. Possibly it came from the stomach of another fish. Two specimens, 120–188 mm. in total length, were taken by "Atlantis" in Lat. 40° 01′ N., Long. 68° 06′ W., in a Blake-trawl which fished bottom in 1230 fathoms, July 27, 1939.

This species has been recorded, according to Ege (1934: 20), in the North Atlantic from Lat. 28° 15′ N. to southeastern Greenland and southern Iceland. Captures have been made at all levels from near the surface to at least 1000 fathoms.

MELANOSTOMIATIDAE

Chirostomias pliopterus Regan and Trewavas, 1930

One specimen, 93 mm. in total length, was taken in Lat. 35° 31′ N., Long. 69° 15′ W., in a 2-meter ring-net fishing 0–850 meters September 5, 1936. This specimen agrees well with the description of Regan and Trewavas (1930: 54) and with their figure on Plate I.

Atlantic Ocean north of 20° N. in a depth range of 55–700 fathoms.

CHAULIODONTIDAE

Chauliodus sloanei Schneider, 1801

One specimen, 82 mm., from Lat. 40° 05′ N., Long. 67° 52′ W., Blake-trawl fishing bottom in 1325 fathoms, July 25, 1939; one 112 mm. from Lat. 39° 50′ N., Long. 66° 50′ W., Blake-trawl fishing bottom in 2030 fathoms; one 250 mm. from Lat. 38° 25′ N., Long. 71° 04′ W., Sept. 2, 1935, 2-meter ring net, 0–360 fathoms.

Western Atlantic northward to the offing of New England; circumtropical; probably most plentiful in the upper 500 fathoms.

GONOSTOMATIDAE

Gonostoma bathyphilum (Vaillant), 1884

Two specimens, 150–154 mm. long to base of caudal, were taken in Lat. 39° 09′ N., Long. 68° 05′ W., in a Blake-trawl which fished bottom in 1280 fathoms, July 27, 1939.

North and South Atlantic. Beebe (1937: 201) records captures in hauls at 700–1000 fathoms, and Parr (1937: 41) with 8000–10000 feet of wire. Recorded down to 1430 fathoms.

Gonostoma elongatum Günther, 1878

A fish 191 mm. long was taken in Lat. 39° 18′ N., Long. 70° 32′ W. in a 2-meter ring-net haul of 0–400 meters, July 16, 1938.

Known from the North and South Atlantic Oceans, Indian Ocean and Hawaiian Islands. Deepest catch 2369 fathoms.

SERRIVOMERIDAE

Serrivomer beanii Gill and Ryder, 1883

One fish, 390 mm. long, was taken in Lat. 39° 40′ N., Long. 71° 43′ W. in a Blake-trawl fishing 820 fathoms, August 11, 1937, and another, of 605 mm. in about Lat. 39° N., Long. 70° W. on September 3, 1936, in a 2-meter ring-net hauled in 0–800 meters.

North Atlantic Ocean between 50 and 1000 fathoms and down to 3281 fathoms (Beebe and Crane, 1936: 54).

EURYPHARYNGIDAE

Eurypharynx pelecanoides Vaillant, 1882

One specimen, 430 mm. long, was taken in Lat. 40° 01′ N., Long. 68° 06′ W., in a Blake-trawl fishing bottom in 1230 fathoms, July 27, 1939.

Atlantic Ocean; on our coast northward to the offing of Nova Scotia. Bathypelagic.

SYNODONTIDAE

Bathysaurus ferox Günther, 1878

One specimen, 605 mm. long, was taken in Lat. 40° 01′ N., Long. 68° 06′ W., July 27, 1939, in a Blake-trawl which fished bottom in 1230 fathoms.

Recorded from the western Atlantic in Lat. 38° to 40° N., Long. 68° to 72° W.; eastern Atlantic from Lat. 27° to 50° N., Long. 8° to 33° W.; New Zealand. Depth range 647–1730 fathoms.

MYCTOPHIDAE

Myctophum affine (Lütken), 1892

One specimen, 89 mm. long, was taken in Lat. 34° 04′ N., Long. 65° 56′ W. with a surface light at night, June 23, 1938, and one 38 mm. was brought up in Lat. 40° 04′ N., Long. 68° 05′ W., in a Blake-trawl which fished bottom in 1250 fathoms, July 26, 1939.

Atlantic, Pacific and Indian Oceans.

Myctophum hygomi (Lütken), 1892

One fish was taken in Lat. 40° 04′ N., Long. 68° 05′ W., and another a few miles away in Blake-trawl hauls made in 1230–1250 fathoms, July 26–27, 1939. Length 50–63 mm.

Atlantic Ocean, Mediterranean Sea, Indian Ocean.

MACRURIDAE

Nematonurus armatus (Hector), 1875

Macrurus armatus Hector, Ann. Mag. Nat. Hist., (4) 15, 1875: 81.
Coryphaenoides gigas Vaillant, Possions Exped. Scient. du Travailleur et du Talisman, 1888: 232, pl. XX, fig. 2.

Depth 7; head 5.5; eye 4.3; snout 3.9; maxillary 2.7; interorbital 3.9; D. II-8, 90; A. 92; P. 20; V. 10. Scales about 150. The body is elongate, and much compressed posterior to first dorsal from which it tapers to the almost filamentous tip of the tail. The upper profile rises slightly from the interorbital to the first dorsal, posterior to which it continues almost straight. The lower profile, from the ventrals to the end of the tail, converges evenly with the upper. The scales are not very deciduous, have strong spines and are present everywhere on the body and top and sides of head. On many of the head scales the spines are radial, mostly in 7 to 9 rows while on most of the body scales they are parallel, chiefly in from 3 to 7 rows. The median row is somewhat the stronger on most of the scales and the spines in several or all of the rows extend beyond the margin. The lateral line rises gently anteriorly and ends a little short of and slightly above the upper angle of the operculum. The chin barbel in length is about two-thirds the horizontal diameter of the eye. There are numerous pores around the upper and the lower jaws.

The snout, which is somewhat damaged in the single specimen at hand, is rather blunt and extends a little beyond the mouth. A small knob at the tip is encrusted with small spiny scales. The eye, which nearly equals the interorbital width, is situated high, and enters the anterior profile. The interorbital is flat. The nostrils are situated immediately in front of the eye, the posterior pair being the larger. Branchiostegals 6. The mouth is situated on the lower side of the head, is nearly horizontal and of moderate size. The protractile upper jaw extends slightly beyond the lower. The maxillary goes 2.7 in the head and reaches the posterior one third of the eye.

The teeth, the same in both jaws, are relatively large (compared with the teeth of other species in this family) rather widely spaced, movable, and both upper and lower are in a single row. No vomerine or palatine teeth. The gill rakers are very short and there are 7 on the free portion of the lower limb of the first arch, part of which is attached by a membrane to the outer wall of the gill cavity.

The first dorsal originates less than an eye's diameter posterior to the origin of the pectoral. The first spine is very short while the second goes 1.44 times in the head and is rather strongly serrated, with 5 closely spaced spines near the base followed by about 10 spines which decrease in size and become more widely spaced toward the tip. The distance between the dorsals is equal to two-thirds the length of the head.

The second dorsal originates over the seventh anal ray. The sixth ray equals nearly one-half the diameter of the eye and the rays continue about the same length to the end of the tail, a small piece of which is missing in the specimen at hand.

The anal originates immediately behind the anus. The sixth ray somewhat exceeds the diameter of the eye and, like the dorsal, the rays continue about the same length to the end of the tail. The pectoral originates over the ventral fin, its outer margin is rounded, the upper rays are longest and go 1.7 in the head. The first ray of the ventral is filamentous and goes 2.2 in the head; the second ray 3.2. Color blackish.

One specimen, 340 mm. long, was taken in Lat. 39° 50′ N., Long. 66° 50′ W., in a Blake-trawl fishing 2025 fathoms, July 24, 1939.

Koefoed (1932: 109) gives a detailed account of this species in the eastern Atlantic and points out that there appears to be a considerable difference in the spination of the scales and of the serrated dorsal ray, according to age, and possibly habitat.

The "Atlantis" specimen is the first to be recorded from the western part of the North Atlantic. Previous records have been from the vicinity of the Azores, Bay of Biscay, Pacific Ocean, and New Zealand, in depths ranging from 406 to 2611 fathoms.

Chalinura simula Goode and Bean, 1883

Chalinura simula Goode and Bean, Bull. Mus. Comp. Zool., 10, 1883: 199. This species is described in detail by Goode and Bean (1896: 412) and by Koefoed (1932: 100).

Depth 6.8; head 4.9; eye 6; snout 3.5; maxillary 2.2; interorbital 4.3; D II–8, 120; anal about 120; P. 19; V. 9. Scales about 155. In the "Atlantis" specimen the pectoral goes 1.7, and the ventral fin, without fila-

ment, 3.2 in the head. The filament of the ventral is 1.3 times the length of the head and reaches the 10th anal ray. The pectoral originates about over the ventral and nearly an eye's diameter in advance of the dorsal. The scales are deciduous, not one remaining on the specimen at hand, and there are about 80 rows counting backward two head lengths from the upper angle of the opercle. Gill rakers short, 9 on the lower limb of the first arch.

The teeth in the upper jaw are in a rather wide villiform band, outside of which there is a single row of large teeth (40 counted) which curve inward at the tip. The teeth in the lower jaw are in a single row, straight, smaller than the large upper teeth and slightly more crowded.

The first dorsal spine is very short; the second (broken) is serrated, the spinules being close together and appressed to the spiny ray.

The one specimen in the M.C.Z. collection, 465 mm. long, has this same arrangement of spinules on the serrated dorsal ray. The tail is regenerated whereas in the "Atlantis" fish it is intact and continues almost to a filament.

One specimen, 440 mm. long, was taken in Lat. 39° 50′ N., Long. 66° 50′ W. in a Blake-trawl fishing 2025 fathoms, July 24, 1939.

Known from the coast of North America from Lat. 31° to 41° N. and from Long. 65° to 78° W., and from Denmark Strait, in depths ranging from 333 to 2025 fathoms.

Coryphaenoides bairdi (Goode and Bean), 1877

Macrourus bairdi Goode and Bean, Amer. Journ. Sci. Arts., 13, 1877: 471.

This common species may be recognized from other macrurids here described by its large eye which goes about 3 in length of the head [2.6 (fish 150 mm.) to 3.1 (fish 310 mm.)], by having usually II, 11 rays in the first dorsal and by its rather nondeciduous (compared with other species) scales, the exposed part of which is covered with small spinules, mostly in about 15 to 20 rows.

This grenadier is one of the most abundant fish on our continental slope below 100 fathoms (Bigelow and Welsh, 1925: 468). Occasionally it is taken in shoaler water (Bigelow and Schroeder, 1936: 340) and has been recorded as deep as 1255 fathoms. "Atlantis" trawled 18 specimens 150 to 400 mm. long, August 11, 1937, in Lat. 39° 28′ N., Long. 71° 58′ W. in 640 fathoms.

Known from along the continental slope from the Grand Banks of Newfoundland to the West Indies.

Coryphaenoides carapinus Goode and Bean, 1883

Coryphaenoides carapinus Goode and Bean, Bull. Mus. Comp. Zool., 10 (5), 1883: 197.
Macrurus carapinus Koefoed, Rept. "Michael Sars" North Atlantic Exped. 1910. Bergen Mus., 4, pt. 1, 1927 (1932): 107.

Eye 5 to 5.6; snout 2.8 to 3; maxillary 2.7 to 3; interorbital 2.7 to 3.1; D. II, 8; P. 18 or 19; V. 9 to 11.

The pectoral goes 1.5 to 1.8 and the ventral, without filament, 2.2 to 2.6 in the head, the filament reaching beyond the anus. The pectoral originates slightly in advance of the dorsal which is about over the ventral. In the specimens at hand the position of these fins, with respect to each other, agrees with the type.

The scales are deciduous but fortunately a few remain on the "Atlantis" fish and these were as follows: near the origin of the pectoral fin the scales were thin and without armature. A short distance posteriorly, along the side, the few scales found were faintly armed with a single small spinule in 3 or 4 rows. Along the side, opposite a space between the dorsals, the one scale found was conspicuously armed with 9 rows of spines which diverge outward very slightly and do not extend beyond the margin of the scale. Farther back along the side, under the origin of the second dorsal, and also a little posterior to this, a small patch of scales had 8 to 10 slightly diverging rows of spines, some of which extended beyond the scale margin. Accordingly, the scales on this species appear to be unarmed anteriorly and probably near the bases of the fins, and armed posteriorly, especially along the sides. This accounts for the two smooth scales found by Goode and Bean (1883: 197) at the base of the dorsal, the only scales they were able to find. There are about 50 to 60 rows of scales counting backward two head lengths from the upper angle of the opercle. The gill rakers are short, with 10 on the lower limb of the first arch.

The teeth in the upper jaw are in a narrow villiform band with the outer series enlarged and curving slightly inward. In the lower jaw the teeth are grouped irregularly in several rows near the symphysis, and are in two rows and then one row going toward the angle of the mouth. The lower teeth are all about the same size and somewhat smaller than the large upper series.

The first dorsal spine is very short and covered with skin. The second spine, 1.5 in the head, has rather weak serrations, the lower one-fifth or one-sixth being smooth or having appressed spinules. Toward the tip of the serrated ray the spinules extend outward to an angle of about 30°. The length of the dorsal rays is from one-half to an eye's diameter, while the anal rays are about 1½ the eye.

Seven specimens taken by "Atlantis" have been compared with the type in the M.C.Z. (Cat. No. 28005). They were taken in four closely spaced Blake-trawl hauls in the vicinity of 39° to 40° N. latitude and 68° longitude, July 26–27, 1939, in depths ranging from 1100 to 1325 fathoms.

This species is known from the western North Atlantic between the offing of Chesapeake Bay and the eastern slope of Georges Bank, and from the eastern Atlantic near the Canary Islands, the Azores and to the northward of the Azores in depths varying from 665 to 1730 fathoms. A locality of 29° 22′ N. latitude given by Goode and Bean (1896: 405) is an error and should be 39° 22′ N.

Gadidae

Antimora rostrata Günther, 1878

Antimora rostrata Günther, Ann. Mag. Nat. Hist., 5, II, 1878: 18.
Haloporphyrus viola Goode and Bean, Proc. U. S. Nat. Mus., 1, 1878: 257.
Antimora microlepis Bean, Proc. U. S. Nat. Mus., 13, 1890: 38.
Antimora rhina Garman, Mem. Mus. Comp. Zool., 24, 1899: 185.

Antimora rostrata Günther and *Haloporphyrus viola* Goode and Bean were found by Koefoed (1932: 118) to be synonymous and this was substantiated by a study of material in the M.C.Z. collection. Differences may

exist among specimens taken in the same haul or in the same immediate locality. For example, the snout is rounded on a 477 mm. specimen, more acute on a 486 mm. fish and still more acute on one of 246 mm. Three fish, 115, 128 and 327 mm. long have a small but sharp protuberance at the tip of the snout, lacking on other specimens of various sizes.

From five "Atlantis" specimens 246 to 486 mm. in total length, the following proportions were obtained: head 3.8 to 4.4 in standard length; eye 3 (smallest fish) to 4.5 (largest fish); snout 3 to 3.2; interorbital 3.2 (large fish) to 4.2 (small fish), in head. Dorsal 4 or 5, 53 to 55; anal 39 to 42; scales in 137 to 143 rows; gill rakers 5 + 11 (one specimen). The tail is square or emarginate and usually frayed at the end.

Bean's (1891: 35) description of *Antimora microlepis* agrees well with those given for *A. viola* and *A. rostrata.*

A specimen labeled *microlepis* in the collection of the M.C.Z. (Cat. 28250, Albatross Sta. 3344, off coast of Washington) gave the following proportions: total length 166 mm.; head 3.7; eye 3.6; snout 3; interorbital 4.2; dorsal 4,54; anal 40; scales ca. 145; gill rakers 11 on lower limb. Snout rounded, with small protuberance at tip. Laid beside specimens of *rostrata* of nearly the same size no significant external differences were noted.

Garman's types of *A. rhina* (M.C.Z. nos. 28610, 28611, 3 specimens 263-292 mm. long) could not be separated from specimens of *A. rostrata.* A fish 286 mm. was as follows: head 4.1; eye 3.7; snout 3; interorbital 4.1; dorsal 5,52; anal 40; scales ca. 140; gill rakers on lower limb 12, including 3 rudiments. Another specimen had 12 and no rudiments. Snout rounded, rather sharp at tip but with no definite protuberance.

The habitat of *A. rostrata* as now defined includes the North and South Atlantic Oceans (Newfoundland to Uruguay; northern Europe) eastern Pacific Ocean (Canada, Washington, Panama) and the southern Indian Ocean (between Kerguelen Island and the Cape of Good Hope; and Marion Island). The depth range is from 306 to 1456 fathoms.

The "Atlantis" collection includes 6 specimens taken the summers of 1937, 1938 and 1939 from several localities in the vicinity of 39°–40° N. latitude and 68°–72° W. longitude in a depth range of 820–1230 fathoms.

Caulolepidae

Caulolepis longidens Gill, 1883

Caulolepis longidens Gill, Proc. U. S. Nat. Mus., 4, 1883: 258.
Caulolepis subulidens Garman, Mem. Mus. Comp. Zool., 24, 1899: 60, pl. B.

Depth 1.8 to 2.3; head 2.5 to 2.9; eye 4.8 to 5.2; snout 3.8 to 4.; interorbital 2.8 to 3.4; D. 18 to 20; A. 9 or 10; P. 15 or 16; V. 7.

These proportions and counts are based on four specimens in the M.C.Z. collection from the North Atlantic. Garman's type of *C. sublidens,* from the Pacific, could not be separated from *longidens.* The anal count of Garman's type was found to be 9 instead of 8 as given in the original description (Garman, 1899: 60).

One specimen, 133 mm. long, was taken in Lat. 39° 28′ N., Long, 71° 58′ W., in a Blake-trawl which fished bottom in 640 fathoms, August 11, 1937.

East coast of North America from the Caribbean to the southern slope of Georges Bank; mid-Atlantic; Gulf of Guinea; Azores; in the Pacific off San Diego and Panama, down to 1832 fathoms.

Brotulidae

Dicrolene intronigra Goode and Bean, 1882

One specimen, 281 mm. long, from Lat. 39° 28′ N., Long. 71° 58′ W., in 640 fathoms, August 11, 1937.

Known from the Caribbean Sea, Gulf of Mexico and northward along the eastern coast of the United States to Lat. 41° 53′ N., off northwest and the northeast coasts of Africa, Arabian Sea, Bay of Bengal. Most of the captures have been in 464-982 fathoms but Koefoed (1932: 134) records a specimen from about 5000 meters (2734 fathoms).

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Food of the Long-nosed Gar (*Lepisosteus osseus oxyurus*) and the Bowfin (*Amia calva*) in Southern Michigan[1]

By Karl F. Lagler and Frances V. Hubbs

GARS and bowfins are classed as "noxious fishes" in Michigan and as such are often removed from sport-fishing waters. The data here presented were gathered in order to obtain a preliminary idea as to whether or not such control might be justified. Comparison of these results with those of other investigators and conclusions regarding the economic status of these predatory fishes, however, are reserved until further studies have been completed.

Long-nosed Gar

The findings on the food of adult long-nosed gar are based on the analysis of the contents of the stomachs of 136 specimens; the stomachs of 68 additional individuals were empty. These gars were speared and netted during the months of June through August from ten lakes, and from the Grand River, in southern Michigan. The stomach contents totalled 893 cc. in volume.

The food of these gars was almost entirely composed of fish (Table 1). The numbers and kinds of the fishes and other organisms eaten follow:

Game and Pan Fishes.—7 bullheads (*Ameiurus* sp.); 23 perch (*Perca flavescens);* 1 green sunfish (*Lepomis cyanellus);* 6 bluegills (*L. macrochirus);* 1 long-eared sunfish (*L. megalotis peltastes);* 2 pumpkinseeds (*L. gibbosus);* 6 sunfishes (Lepominae, specifically unidentified); 1 bass or sunfish (Centrarchidae).

Table 1

Food of the Long-nosed Gar in Southern Michigan

Based on the analysis of the food (893 cc.) contained in the stomachs of 136 individuals.

Food Item	Composition by Volume (%)	Frequency of Occurrence (%)
Game and pan fishes......	59.9	25.0
Other fishes..............	36.5	72.1
Fish remains.............	2.4	15.4
Crayfishes...............	1.2	2.2
Insects..................	0.1	4.4

Other Fishes.—1 carp (*Cyprinus carpio);* 1 golden shiner (*Notemigonus crysoleucas auratus);* 4 common shiners (*Notropis cornutus*, one identifiable as *N. c. chrysocephalus);* 27 rosy shiners (*N. rubellus);* 1 spot-tailed shiner (*N. h. hudsonius);* 8 black-chinned shiners (*N. heterodon);* 17 sand shiners (*N. deliciosus stramineus);* 15 mimic shiners (*N. v. volucellus);* 35 black-nosed shiners (*N. h. heterolepis);* 42 minnows (Cyprinidae, unidentifiable to species); 17 brindled madtoms (*Schilbeodes miurus);*

[1] Contribution from the Institute for Fisheries Research of the Michigan Department of Conservation and from the Department of Zoology of the University of Michigan.

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1 mud pickerel (*Esox vermiculatus*); 2 barred killifish (*Fundulus diaphanus menona*); 22 log perch (*Percina caprodes semifasciata*); 7 Iowa darters (*Poecilichthys exilis*); 15 brook silversides (*Labidesthes s. sicculus*).

Fish Remains.—Unidentifiable remains of at least 23 individuals.

Crayfishes.—1 *Cambarus virilis;* 1 *C. propinquus;* 1 *Cambarus* sp.

Insects.—1 neuropteran larva; 7 mayfly nymphs; 1 damselfly nymph.

Bowfin

The food habits data for the bowfin or fresh-water dogfish are from the analysis of the stomach contents of 131 individuals (mostly adult) collected in 15 lakes and the Muskegon River in the Lower Peninsula of Michigan; the stomachs of 35 additional specimens from these waters were empty. These specimens were obtained by employees of the Michigan Department of Conservation during the months from April through September. Some were speared, others were taken by angling.

About 0.6 of the entire amount of food (1812.1 cc.) eaten by these bowfins is composed of game or pan species (Table 2). The numbers and kinds of fishes and other organisms follow:

Game and Pan Fishes—7 bullheads (*Ameiurus* sp., 2 identified as *A. n. natalis*); 59 perch (*Perca flavescens*), and 2 fish identifiable only as Percidae; 1 small-mouthed bass (*Micropterus d. dolomieu*); 1 large-mouthed bass (*Huro salmoides*); 26 sunfish (Lepominae, including 11 bluegills, *Lepomis macrochirus*, 1 long-eared sunfish, *L. megalotis peltastes*, and 7 pumpkinseeds, *L. gibbosus*); 1 rock bass (*Ambloplites rupestris*); 1 bass or sunfish (Centrarchidae).

Table 2

Food of the Bowfin from Waters in Southern Michigan

Based on the analysis of the food (1812.1 cc.) contained in the stomachs of 131 individuals.

Food Item	Composition by Volume (%)	Frequency of Occurrence (%)
Game and pan fishes	59.1	42.0
Other fishes	17.1	14.5
Fish remains	3.2	13.0
Carrion	0.1	1.5
Frogs	5.8	4.6
Earthworms	Trace	42.0
Crayfishes	14.1	64.9
Insects	0.5	14.5
Snails and clams	0.1	1.5

Other Fishes.—2 gizzard shad (*Dorosoma cepedianum*); 1 sucker (Catostomidae); 2 carp (*Cyprinus carpio*); 1 shiner (*Notropis* sp.); 14 other minnows (Cyprinidae); 1 mud minnow (*Umbra limi*); 3 pike or pickerel (Esocidae, probably mud pickerel, *Esox vermiculatus*); 3 Iowa darters (*Poecilichthys exilis*); 1 other darter (Etheostomatinae); 1 brook stickleback (*Eucalia inconstans*).

Fish Remains.—Unidentifiable remains of at least 19 individuals.

Carrion.—A small amount in each of two bowfins.

Frogs.—6 frogs (including 1 bullfrog, *Rana catesbeiana*, and 1 *Rana* sp.).

Annelida.—2 earthworms.

CRAYFISHES.—49 *Cambarus virilis;* 10 *C. immunis;* 52 *C. propinquus;* 1 *C. robustus;* 27 *Cambarus* sp.

INSECTS.—1 mayfly nymph (*Hexagenia* sp.); 1 adult dragonfly; 67 dragonfly nymphs; 1 damselfly nymph; 3 beetles (including 2 referable to the Dytiscidae); 22 caddisfly larvae; 1 soldierfly larva (*Stratiomyia* sp.); remains of one unidentifiable insect.

SNAILS AND CLAMS.—Remains of 8 individuals.

ACKNOWLEDGEMENTS

The authors are indebted to employees of the Michigan Department of Conservation who collected the gars and bowfins. Thanks are extended Mr. Jerome Watts of the Institute staff who assisted in the laboratory work. The helpful suggestions of Professor Carl L. Hubbs are acknowledged with gratitude.

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Notes on *Lampropeltis* in Kentucky

By RALPH DURY and WILLIAM GESSING, JR.

WHILE engaged in herpetological study and field work in Kentucky the authors and their associates have collected and preserved a number of interesting king snakes. In view of the scanty material from this state that was available to Blanchard (1921) in his monograph it seems worthwhile to place on record the following notes. Acknowledgements for assistance in acquiring specimens and in preparation of this paper are due Mr. Roger Conant, Mr. Raymond Williams, Mr. Woodrow Goodpaster, Mr. R. J. Fleetwood, Dr. Charles F. Walker, Mrs. Helen T. Gaige and Dr. C. M. Bogert. The following abbreviations are used: CSNH—Cincinnati Society of Natural History; BHFM—Baker-Hunt Foundation Museum of Covington, Kentucky; AMNH—American Museum of Natural History; and UMMZ—University of Michigan, Museum of Zoology.

Lampropeltis getulus nigra (Yarrow)

Typical specimens of this subspecies have been obtained from seven widely separated counties in the state, namely; Carter, Rowan, Madison, Henderson, Daviess, McCracken and Fulton. The specimens from all except Fulton County have the light dorsal scale spotting concentrated to form from 40 to 50 definite transverse bars or rings. CSNH 2394 and 2465 from near Reelfoot Lake are as typical of *nigra* as are the specimens from Carter County, over 300 miles to the northeast.

A series of 4 other specimens from Fulton County, near Reelfoot Lake, shows great diversity in pattern. Of these, CSNH 2248, 2358, and 2384, all

females, have the small light spots on nearly all their dorsal scales; but concentrated enough to form indistinct bars or rings; CSNH 2385, a male, has the light spotting on all but a very few of the dorsal scales with the cross-barring concentration of white barely perceptible.

The Fulton County specimens of *nigra* constitute, as far as we know, the westernmost records for the subspecies.

A series of three specimens from Carter County, CSNH 2008 a, b, c, have the light dorsal crossbars obsolete, the dorsal coloration assuming an almost uniform black appearance. These specimens are adults over 1000 mm. in length.

Lampropeltis g. nigra has also been reported from Edmonson County, Hibbard, 1936, and Bailey, 1933; Breathitt County (University of Kentucky collection); and Carlisle County (Toledo Zoo collection).

Lampropeltis g. holbrooki has been reported from Reelfoot Lake, Tennessee, by Blanchard (1921), and Parker (1937). In referring to *holbrooki,* Parker writes "Reelfoot Lake is in the area of intergradation of this subspecies with *L. g. nigra,* which is the predominant subspecies in the county to the eastward." Some of our specimens, considered individually, might be referred to *holbrooki,* but the population as a whole seems definitely nearer to *nigra.*

Lampropeltis calligaster (Harlan)

A specimen of this species, CSNH 1662, collected at Ft. Knox, Hardin County, is probably the first record for the state based on a preserved specimen. CSNH 2020, Hardin County, provides the easternmost record for the species. Other specimens in the collection are CSNH 2415, from Brandenburg, Meade County, and CSNH 2320 and 2351 from the Massac Creek area, McCracken County.

Hibbard (1936) has recorded five specimens of *calligaster* from the Mammoth Cave Park.

Lampropeltis triangulum triangulum (Lacépède)

Preserved specimens have been examined from Harlan, Grant, Letcher, Bell, Kenton and Campbell counties. It was also recorded by Burt (1933) from Hardin and Nicholas counties, and by Hibbard (1936) from Edmonson County. All specimens examined are typical of *triangulum* in scutellation, color, and color pattern.

Lampropeltis triangulum syspila (Cope)

The occurrence of this subspecies in Kentucky is proved by the following preserved specimens, the first from the state: CSNH 2349, Hickman County; CSNH 2411, Fulton County, near Reelfoot Lake; CSNH 1957, Christian County.

The Hickman County specimen has 28 bright red dorsal blotches reaching downward on the sides to the second row of scales, these alternating with indistinct dark blotches. The head and anterior end of body are typical, showing the light half-collar behind the head instead of the Y-shaped head pattern of *triangulum.*

The Christian County specimen, a male, has 26 blotches reaching to the

first or second rows of scales; the head markings are intermediate between *syspila* and *triangulum*. The light black-edged area on the parietals is reduced to a rather small oval-shaped marking. The single series of alternating lateral blotches are distinct, reddish, and bordered with black.

CSNH 2411, from Fulton County, has 24 dorsal blotches that reach to, or overlap onto, the venter, most prominently at midsection. A single series of dark alternating blotches is present. There is a light oval-shaped marking behind the parietals outlined in black.

Lampropeltis elapsoides virginiana Blanchard

After carefully examining 3 specimens from Kentucky and one specimen from Western Tennessee we refer them to this subspecies.

In one specimen, BHFM 153 from Cumberland Falls, Whitley Co., the red dorsal areas extend only slightly onto the ventral scales, and are entirely surrounded by black. The black rings that enclose the red dorsal areas widen on the belly and merge, forming an irregular stripe on the midline. The white areas on the venter are irregularly blotched with dark pigment.

A specimen from Mammoth Cave National Park, Accession No. 95, recorded as *L. e. elapsoides* by Hibbard (1936), has the red areas extending just to the ventrals, where they are blocked off by the fusion of the black which borders them. The merged black rings do not extend across the midline of the belly, but are broken up and diffused on the venter which is almost immaculate in the midline.

A specimen from Mammoth Cave, AMNH No. 9629, is rather perplexing, with the white areas enclosed in black just as are the red areas in the above two specimens. The red rings extend all of the way around the body, and are only partially bordered with diffused black pigment on the venter. This was the only specimen from Kentucky seen by Blanchard.

A specimen from Decatur County, in western Tennessee, UMMZ No. 72233, has most of the red areas restricted to black-bordered saddles which extend well onto the ventrals. The midline of the ventrals is irregularly spotted with black.

On the basis of these 4 specimens we conclude that all northern specimens of the scarlet king snake from both sides of the Alleghenies should be referred to *L. e. virginiana*, at least until additional material is available.

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The Larvae of *Eurycea bislineata major*

By Harold Trapido and Robert T. Clausen

We have recently had opportunity to examine a series of 88 specimens, mostly larvae, of *Eurycea bislineata major* Trapido and Clausen, taken in the Laurentides National Park, Quebec, during the summer of 1938. We named this subspecies on the basis of adult material (1938), and we can now point out the larval characters which differentiate *Eurycea bislineata major* from *bislineata*. The comparisons with and distinctions from the latter are based on material from the vicinity of Ithaca, New York. We are grateful to Mr. Richard Bernard for acquainting us with the *E. b. major* material, and indebted to Dr. V. D. Vladykov, Director of the Biological Station of the Laurentides National Park, for the opportunity to examine the specimens collected by him and his colleagues, and to Miss Octavia Bailey for her painstaking drawings illustrating the larvae.

Oliver and Bailey (1939) have suggested that the characters used to distinguish *major* are insufficient for the adequate definition of a nomenclatorially recognizable race. Since we consider subspecies to be variations geographically correlated and hence worthy of recognition, *E. b. major* still impresses us as significant and taxonomically valid. Although the characters of the adults represent developments correlated with extreme size, this tendency toward largeness, with associated characters, has yet to be duplicated generally by another regional population.

The larvae of *E. b. major* of all sizes from 15 mm. to 70 mm. differ strikingly from those of *E. b. bislineata* in coloration. *E. b. major* is much darker than *E. b. bislineata,* as reference to the accompanying drawings will show. Of more significance, perhaps, than this mere intensification of the coloration, are the differences in pattern. In *E. b. bislineata* (fig. 1, A) the color pattern of the sides continues across the back, only interrupted by the series of dorso-lateral light spots; in *E. b. major* these dorso-lateral light spots border a relatively light band down the back (fig. 1, B). Individuals of *E. b. bislineata* approaching transformation and adult coloration have the back lighter than the sides, but the light dorsal band mentioned above is found in *E. b. major* of all sizes, even newly hatched specimens of 15 or 16 mm. The clear throat region of *E. b. major* is marked by the encroachment on each side of a semicircle of the dark dorsal pigmentation (fig. 1, D): in *E. b. bislineata* there is seldom even any indication of ventro-lateral pigmentation in the throat region (fig. 1, C). Three or four of the largest *E. b. major* (68–70 mm.) show a marked development of dark ventral coloration on the body (fig. 1, D). We have never seen *E. b. bislineata* with other than a clear venter. The darkening of the belly apparently occurs in only the oldest of *E. b. major* larvae.

The shape of the fin fold perhaps affords the most significant difference. *E. b. major* has the fin rising more abruptly at the base of the tail, and more truncate at the end, as well as higher over its entire length (fig. 1, E), than in *E. b. bislineata.*

Since working out these differences we have been able to examine a series

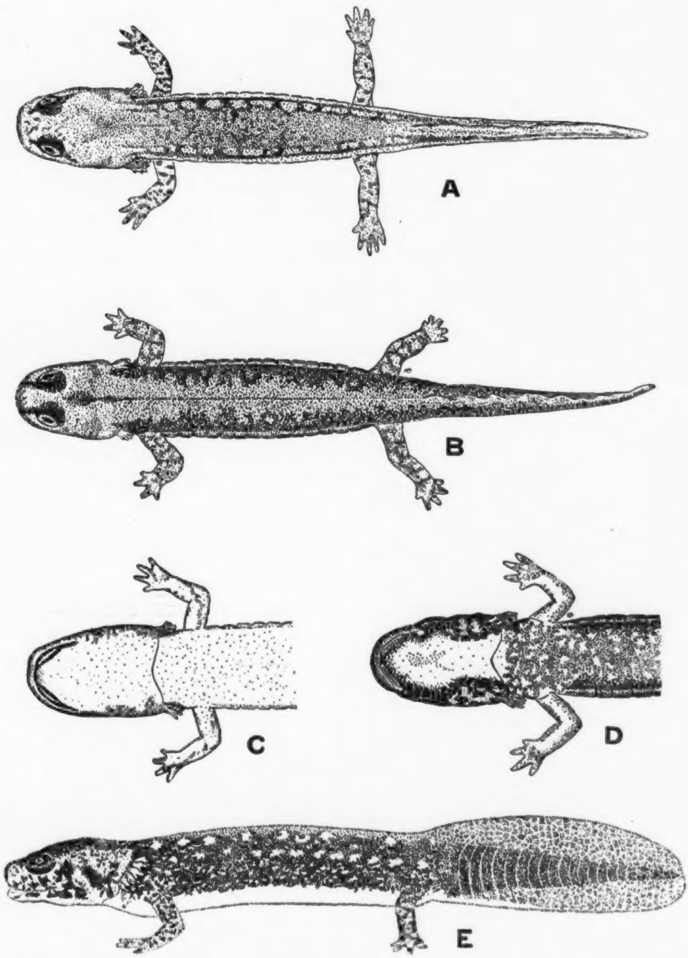

Fig. 1. Larvae of *Eurycea bislineata bislineata* and *E. b. major*. A, dorsal view of 37.5 mm. *E. b. bislineata* from Ithaca, New York; B, dorsal view of 37.5 mm. *E. b. major* from the Laurentides National Park, P. Q.; C, ventral view of 43 mm. *E. b. bislineata* from McLean, New York; D, ventral view of 68 mm. *E. b. major* from Laurentides National Park, P. Q.; E, lateral view of *E. b. major* from Laurentides National Park, P. Q.

of 31 larvae from eight localities in the Merrimac River drainage of New Hampshire, collected by Dr. R. M. Bailey and Mr. James Oliver. These presumably represent *E. b. bislineata,* but they show certain of the *E. b. major* characters: they are very dark in color, and some of the specimens have the light dorsal band noted in the northern subspecies. Their fin fold is not so high, nor so truncate as in *E. b. major,* but more rounded than in *E. b. bislineata* from Ithaca.

While the available material of *E. b. major* is not sufficiently abundant for a positive conclusion, there is a strong indication that this subspecies transforms at a larger size than is normal for *E. b. bislineata.* The smallest transformed specimen of *E. b. major* we have seen is 77 mm. in total length. The larvae, as the series from the Laurentides National Park shows, reach a size of at least 70 mm. Transformed *E. b. bislineata* of 40 to 50 mm. are common at Ithaca, and we have seen one of only 35 mm. from West Virginia. It is true, however, that New York larvae of 60 mm. are sometimes found, but they are by no means common. Wilder (1899) found the largest larva in a series of 90 specimens from Williamstown, Massachusetts, to be 52 mm. in total length. The data of Wilder (1924) on 2408 larvae from the vicinity of Sunderland, Massachusetts, are so condensed that it is impossible to determine the exact sizes of individuals, but it is evident that all but a very few of this tremendous series are under 61.5 mm. in total length. Possibly, then, *E. b. major* normally transforms only after three winters as larvae, rather than after two winters as is most often the case with *E. b. bislineata.* This can only be determined, however, after study of larger series of *E. b. major* than are now available.

Dr. Vladykov has supplied us with chemical and physical data on the waters in which his specimens were found. The series was taken in thirteen collections in the inlets and outlets of various lakes of the Laurentides National Park, in water ranging in depth from 4 inches to 2 feet, under the following conditions:

	Lowest	Highest	Average
pH	5.2	6.3	5.9
Oxygen (parts per million)	7.38	9.96	8.37
Water temperature (°C)	9.8	20.0	16.5

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Contributions to the Life Histories of *Dicamptodon ensatus* and *Ambystoma gracile*

By Wilbur V. Henry and Victor C. Twitty

In the literature concerning the life history of *Dicamptodon ensatus* (Eschscholtz) there is at present some confusion regarding its larval life. Noble (1927: 41, and 1931: 49) used an illustration of the larva of this form to show typical mountain-brook larval characters. In the same figure he used an illustration of the larva of *Ambystoma gracile* (Baird) to show pond type larval characters. Storer (1925: 81) ascribed to *Dicamptodon,* by reason of their size and location, large masses of amphibian eggs which averaged 75 mm. in diameter and which were deposited in the still waters of a mountain lake near Ukiah, Mendocino County, California. The apparent discrepancy between site of egg laying and larval type was covered by a statement that the larvae must make their way into streams where they assume all the characters of the mountain-brook larval type. The data on which the present report is based may help to clarify this situation.

On April 23, 1935, at a locality not greatly removed geographically from the locality cited by Storer for *Dicamptodon* eggs, and where biotic conditions are apparently similar, three large masses of amphibian eggs were collected from a quiet pool in a slowly flowing mountain stream (see appendix, Locality No. 1). These eggs answered in detail the description supplied by Storer (1925: 81–85, pl. 8, fig. 19) and were brought to the laboratories at Stanford University for observation of their development. There shortly appeared typical balancers, an extensive body-fin, and a distinctive pigment pattern (fig. 2a), all suggestive of *Ambystoma* larvae of a type not unlike *A. maculatum* (Shaw). These characters became more clearly defined as development proceeded. At the time the larvae began to feed they averaged 23 mm. in length and it was noted that the first appearance of the hind limb buds coincided approximately with this stage. This measurement reflects the large initial size of the eggs of this species. In *A. maculatum,* for example, itself a species with relatively large eggs, the embryos measure only about 16 mm. when yolk resorption is complete.

The discrepancies between the characters of the larvae developing from these eggs (fig. 2b) and the definite brook type larval characters exhibited by very small *Dicamptodon* larvae obtained directly from swift streams made obvious the fact that we were dealing, not with *Dicamptodon,* but with another form, an *Ambystoma.* The larvae died before the onset of metamorphosis, but not before it was possible to identify them as *Ambystoma gracile;* some of the larvae were preserved (Cat. Nos. 5160–64 and 5166–70) in the amphibian collections of the Natural History Museum of Stanford University. The locality record for these eggs and the record of Storer extends the known range of this species over a hundred miles to the south.

Subsequent work in the field substantiated our original observations. July 16, 1935, in a pond in Mount Rainier National Park, Washington, 2 large amphibian larvae were collected at random from a large number present

(see appendix, Locality No. 2). Many recently evacuated egg masses of the type referred to were noted in the pond also. These larvae are definitely those of *Ambystoma gracile,* and the correspondence between these well-developed larvae and those previously reared in the laboratory is complete as far as can be determined.

June 19, 1937, at a mountain ranch in San Mateo County, California (see appendix, Locality No. 3), an adult female *Dicamptodon ensatus* was collected in close proximity to numerous large amphibian eggs fastened singly on the surface of a timber (fig. 1e) which had been partially submerged in a rapidly running stream. About 70 eggs were collected and were brought to the laboratory. All the embryos were at the "tail-bud" stage of development when collected and were completely albino (fig. 1a). Some of them were preserved in formalin and the rest were allowed to continue their development. At an early stage they all exhibited unmistakably mountain-brook characters: the complete lack of balancers, the abrupt ending of the dorsal tail fin at the pelvic region, and the almost simultaneous emergence of the fore and hind limbs (figs. 1b, 1c, 1d). Their appearance as the pigment pattern developed became more and more like that of young free-swimming larvae of *Dicamptodon* obtained directly from streams, and we now believe that there is no question concerning their identity. It was not possible to raise any of these larvae to the stage where independent feeding begins. Their development was extremely slow; in fact, almost five months elapsed before the stage was reached where the yolk approached exhaustion. One of these larvae is preserved (No. 5165) in the amphibian collections of the Natural History Museum at Stanford University.

Appendix on Localities

Locality No. 1.—Ten miles west of Willits, Mendocino County, California, on the Willits-Fort Bragg road, a small stream crosses the road draining a ravine in the typical redwood forest of the area. The flow was quiet and slow even between the many small but deep pools. On a partially submerged dead branch of a tree at a depth of about $2\frac{1}{2}$ feet, and close to the bottom of the pool, were fastened three large jelly masses containing amphibian embryos in an advanced stage of development. In all three masses the embryos were

1a–1d. Embryos of *Dicamptodon ensatus* at different stages of development. 1a.—Stage of development ("tail-bud" stage) on date of collection, x 5.8: Note albino condition and large size of yolk. 1b and 1c.—At first onset of pigmentation: Note in 1b. absence of body-fin; in 1c., absence of balancers and simultaneous appearance of both fore and hind limb buds. 1d.—Slightly older stage of development showing advance in degree of pigmentation.

1e. Portion of timber described, with eggs attached, x 0.43.

2a.–2b. Embryo and larva, respectively, of *Ambystoma gracile,* reared in laboratory from embryos collected near Willits, California. 2a.—Note presence of balancer, well-developed body-fin, and pattern of pigmentation at a stage comparable to that shown in figure 1d. for *Dicamptodon;* about 17 mm. in length. 2b.—Advanced stage in larval development, showing persistence of body-fin and characteristic pattern of pigmentation; about 40 mm. in length.

(Photography by D. Bodenstein, Stanford University).

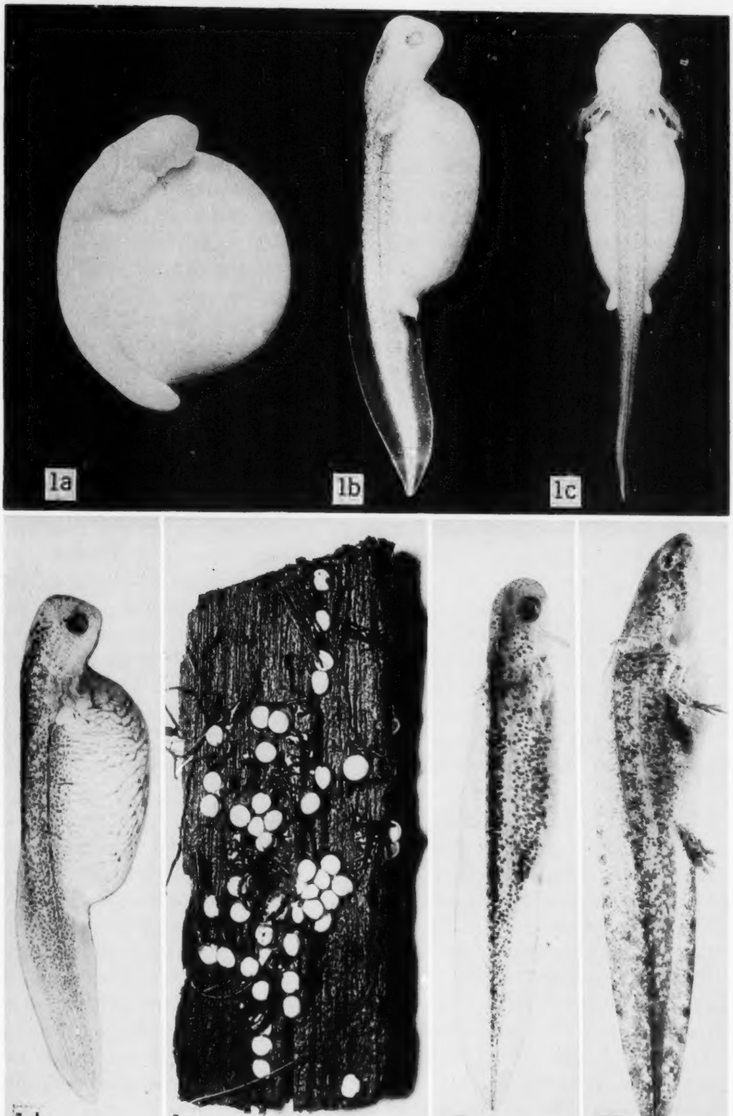

PLATE I

about at the same stage. The egg masses agreed in detail with the description by Storer, including the presence of an inner capsular lining of algae. Present in the pool also were several remarkably agile salamander larvae which defied capture and so remained unidentified.

Locality No. 2.—At a place designated 'Frog Heaven' (elevation about 4400 ft.) on topographic maps of Mount Rainier National Park, two small and fairly shallow ponds were examined. In the larger and more shallow of the ponds, which had a bottom composed of loose sediment and detritus, many recently evacuated egg masses of the type mentioned were observed. In every instance they were attached to submerged pieces of timber or to dead branches from the surrounding trees, and they lay near or at the bottom in about 3 feet of water. No count was made of the egg masses present, but a conservative estimate placed the total number in excess of 25. One mass contained well-developed embryos within the capsules. The soft condition of the jelly, due perhaps in part to the tepid temperature of the water, and the jarring of the mass upon attempting to free it from the timber caused the rapid escape of all the larvae, which quickly wriggled through the semi-fluid jelly and disappeared beneath bits of detritus on the bottom of the pond. Present in the pond also were many large salamander larvae, so large as to have soon reached metamorphosis, or, as the thought presented itself at the time, which might have functioned as axolotls. No metamorphosed individuals were seen on land or in the pond, and the agility of the larvae in escaping the sweeps of a large-meshed net resulted in the capture of only two medium-sized individuals. The larvae captured, Nos. 2207 and 2208 in the collections of the Natural History Museum, were identified as larvae of *Ambystoma gracile* and measured in total length 112 mm. and 130 mm. respectively (in alcohol) although they were by no means the largest individuals seen. In these larvae the dorsal tail fin continues to the back of the head and the parotid region is relatively unswollen, as in Noble's figure (*loc. cit.*).

Locality No. 3.—The ranch of H. L. Brubaker in the heart of the redwood and Douglas fir forests of the Santa Cruz Mountains in San Mateo County, is traversed by two small tributaries of Oil Creek. Mr. Brubaker uncovered the adult *Dicamptodon* while replacing the timbers of a skid-road which crossed one of these streams. On one of the bottom timbers was a group of amphibian eggs attached singly to the surface by pedicels of jelly. We were unable to determine exactly the original position of the timber relative to the water, but the conditions indicated that the eggs were submerged in the running stream. About 70 eggs were collected although some few may have been lost or destroyed in removing the timber from the stream-bed. A few of the eggs were preserved in formalin solution (No. 2235, collections of the Natural History Museum) with no appreciable shrinkage observed. The average diameter of 10 of the capsules, which were very uniform in size and round in shape, was 8.3 mm. (measured to the nearest .5 mm.). The pedicels extended an average of 5.7 mm. from the periphery of the capsule to the point of attachment. The jelly was soft and easily ruptured. Dissection revealed the wall of the capsule to consist of a single coat of jelly about 1 mm. in

thickness within which the embryo was closely fitted, but permitting movement when the egg was tilted. The adult *Dicamptodon* was a female in spawned-out condition when captured, and is preserved (No. 2236) in the amphibian collections of the Natural History Museum. Possibly the animal was in attendance upon the eggs, as has been recorded for certain other species of salamanders, but we arrived at the scene too late to determine this point.

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Stanford University, California.

A New Frog from the Tarahumara Mountains of Mexico

By Edward H. Taylor

AMONG the collections recently forwarded to me by Mr. Irving Knobloch from Mojárachic, Chihuahua, Mexico, is a specimen of frog which appears to be new.

Eleutherodactylus ***tarahumaraensis***, sp. nov.

Type.—EHT-HMS, No. 23008; collected at Mojárachic, Chihuahua, in the Tarahumara Mountains at an elevation of about 6,900 feet, by Irving W. Knobloch.

Diagnosis.—A medium-sized species, with the tips of fingers slightly dilated, tips of toes not dilated, and lacking a transverse terminal groove; outer metatarsal tubercle about two-thirds size of inner; no trace of a tarsal fold or tubercle; no fold on outer edge of outer toe; first finger longer than second; abdomen lacking granules but minutely striated longitudinally; ventral disk ill-defined; skin of dorsal surface more or less uniformly tubercular or corrugated, not tending to form folds; width of eyelid about equal to interorbital distance; tympanum distinct, a little more than half width of eye; vomerine teeth in two low groups between posterior part of choanae, and extending behind them.

Description of Type.—Head broader than body; no canthus rostralis, loreal region posterior to nostril slightly concave; snout extending slightly

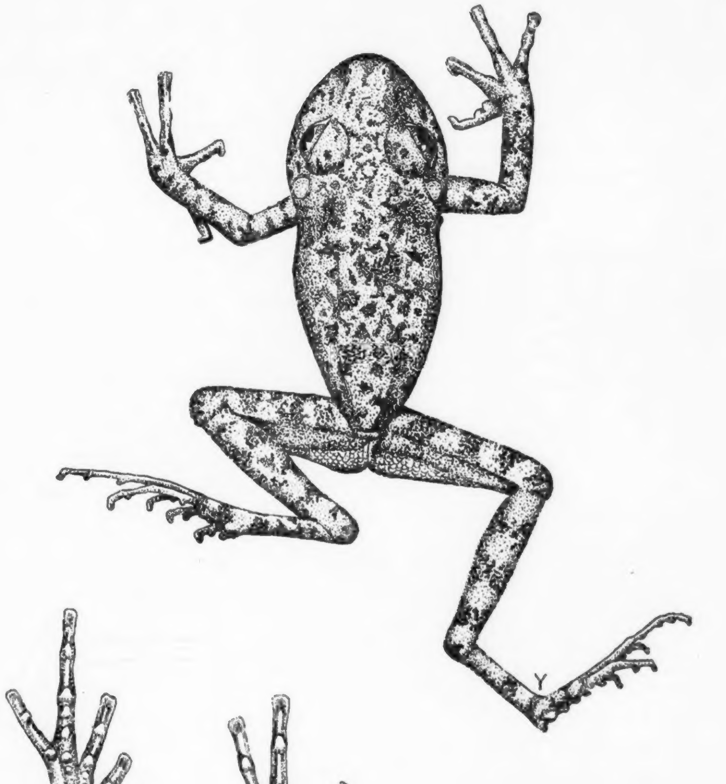

Fig. 1. *Eleutherodactylus tarahumaraensis,* sp. nov. Type, EHT-HMS No. 23008, Mojárachic, Chihuahua, Mexico, Irving Knobloch col. Body, x 1½; hand and foot, x 2; side of head, x 3.

beyond mouth, the nostrils not quite terminal; nostril lateral with a noticeable groove issuing from its lower border; width of upper eyelid (4.3 mm.) equal to interorbital distance (4.4 mm.); tympanum (3.1 mm. x 3.35 mm.) more than half length of eye (5.1 mm.); length of snout, 6.2 mm.; eye to nostril, 5.7 mm.

Choanae small, almost lateral; vomerine tooth groups low, inconspicuous, larger than choanae, extending forward to near level of the middle of choanae and extending behind the posterior level of choanae more than half their length; the groups are separated from each other by a distance about equal to width of one group, from the choanae by two or three times that distance; tongue rather small, free behind for one-fourth its length, slightly emarginate behind.

Arm long, the insertion seemingly directly below tympanum; brought forward, the major part of the forearm reaches beyond the snout; tips of the two outer fingers slightly dilated, of inner fingers not dilated; first finger longer than second; three well-defined palmar tubercles, median largest and much longer than wide; subarticular tubercles large, somewhat conical; an intercalary flattened tubercle between the subarticular tubercles on the two outer fingers; six prominent smaller supernumerary tubercles on bases of fingers and palm; no tubercles under forearm; lateral edges of fingers slightly angular.

Tibiotarsal articulation reaches slightly beyond eye; heels touch when limbs are folded at right angles to the body; third toe very slightly longer than fifth; subarticular tubercles large, conical, strongly salient; supernumerary tubercles between the proximal subarticular tubercles of fourth toe large, smaller on third and fifth; inner metatarsal tubercle large, slightly compressed, about twice the size of outer on right foot, one and one-third size of that on left foot; no trace of tarsal folds or tubercles; digits bordered by very narrow, moderately sharp-edged, lateral folds or ridges; only the faintest trace of web at base of digits, if any.

Skin above with small pustules or granules; on sides the granules are a little more distinct and regular; part of the ventral and posterior face of the femur with flattened granules. Skin of chin and breast smooth; abdomen without trace of granules but skin finely striate longitudinally (normal?); proximally the posterior face of femur is thickened and glandular; surfaces of limbs smooth. A fold above and behind tympanum.

Color.—Bluish-gray to ultramarine above with numerous blackish, irregular spots which show a fine flecking of the ground color; limbs with the ground color somewhat lighter, somewhat flesh on the femur, with the dark flecks and spots forming indistinct bars on arms and legs; concealed parts of the dorsal surface of fingers and toes lightly pigmented; chin, under surface of arms, to a lesser extent the breast and the sides of the abdomen, with finely distributed pigment; median part of abdomen, under side of femur and the lower proximal part of the posterior face without pigment. Under surfaces of hand and foot more or less pigmented save the summits of the tubercles.

Measurements.—Snout to vent, 43 mm.; width of head, 17.5 mm.;

length of head, 15 mm.; arm, 27.5 mm.; leg, 64 mm.; tibia, 22.3 mm.; foot, 29.

REMARKS.—The species, judged by the character of the feet and tubercles, is related to the ***augusti*** group of the genus that includes *augusti, latrans, laticeps* and *cactorum*. It differs however in having longer, slenderer legs, and a slender, rather than a toad-like, body. The specimen is a female, so I cannot say whether vocal sacs are present in the male.

KANSAS UNIVERSITY, LAWRENCE, KANSAS.

A New *Lampropeltis* from Western Mexico

By EDWARD H. TAYLOR

IN a collection recently presented to me by Mr. Irving Knobloch is a striking new form of the genus *Lampropeltis*. The species is represented by two specimens, which agree in all essential characters that can be discerned (the paratype has the head damaged). I take pleasure in naming the species for its discoverer.

Lampropeltis ***knoblochi,*** sp. nov.

TYPE.—EHT-HMS No. 23017, Mojárachic, Chihuahua, Mexico, 1939, Irving Knobloch, collector. Paratype: EHT-HMS No. 23016, same locality and collector.

DIAGNOSIS.—Related to *L. pyromelana* but differs in having quadrangular black-bordered red blotches terminating on the fourth or fifth lateral scale row, and separated from the ventral coloration by an irregular white stripe; spots separated from each other by narrow (one to one and a half scales wide) white transverse bars which contact the white lateral stripe; irregular red ventral blotches separated by white (often dark-edged) lines which contact the white lateral stripe, leaving ventral blotches alternating with the dorsal. Snout cream; a black triangular head spot enclosing a cream spot followed by a curving black spot. Ventrals and subcaudals 289-298; 7 upper, 10 lower labials; 70 spots on body.

DESCRIPTION OF TYPE.—Head moderately distinct from body; rostral narrowly visible above, nearly twice as wide as high; internasals broader than long, their length about three-fourths the length of the prefrontals; frontal shield-shaped, longer than wide, its length equal to its distance from the tip of snout; parietals longer than frontal, less than their distance to tip of snout; nostril between two nasals, which are fused below the nostril and are

divided above nostril; posterior part of nasal highest; loreal longer than high; one large preocular not reaching frontal, touching two labials; two postoculars, the upper highest; temporals 2 + 3 + 4 on each side (anterior tip of one anterior temporal segmented on left side); 7 upper labials, third and fourth border orbit; 10 lower labials, 4 touching the chinshields; anterior chinshields larger and longer than posterior; latter separated by two scales; length of eye less than its distance to the nostril.

Scale formula, 27—23—19; scales with paired apical pits; ventrals, 330; anal single; subcaudals, 68.

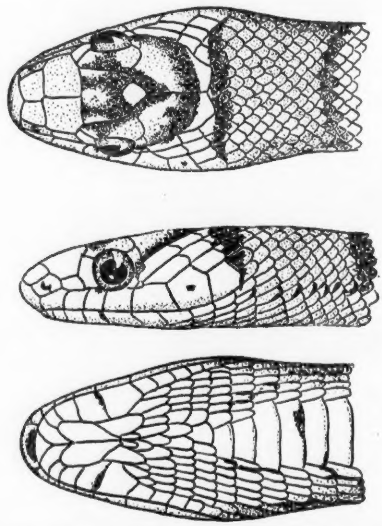

Fig. 1. *Lampropeltis knoblochi*, sp. nov. Type, EHT-HMS No. 23016. Mojárachic, Chihuahua, Mexico, x 2.

Color.—Above, the body with red quadrangular black-edged bands terminating laterally on the lower edge of the fifth scale row; the black edging is wider dorsally than on sides, where it may be almost obsolete; these spots separated by white lines one and one-half to two scales wide; an irregular white stripe runs from the side of the neck to anus (occasionally broken) along the third and fourth scale rows; ventral surface with irregular quadrangular red spots more or less separated medially by black and white spots, and laterally with white lines, one scale wide, which reach the lateral stripe at points which alternate with the points of junction of the dorsal white lines with the lateral stripe; red blotch on neck 6 or 7 scale rows wide, bordered anteriorly and posteriorly with black; a curving white line crosses the occiput involving posterior edges of the parietals; this preceded by a curved black line which touches edge of orbit anteriorly; a triangular black spot between eyes, inclosing a white spot; posteriorly this spot separated from the curved dark line by light areas save at the median point, where they are in

contact; labials and temporal region white; chin whitish; certain of the labial borders show a trace of pigment.

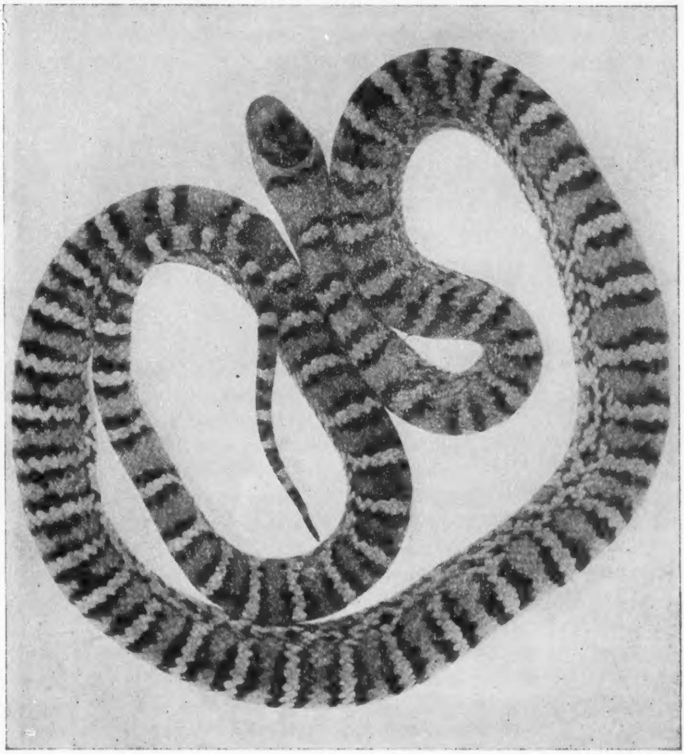

Fig. 2.—*Lampropeltis knoblochi* sp. nov. Type EHT-HMS No. 23016. Mojárachic, Chihuahua, Mexico.

Measurements (of type and paratype, in mm.): total length 717, 707; tail, 117, 120; length of head of type 21.5, width of head, 13.2.

REMARKS.—The paratype, a female, has the black borders of the dorsal red bands less conspicuous. There are 70 red bands as in the type; ventrals, 225, subcaudals, 64; upper labials, 7-7; lower labials, 10-10; the scale formula: 29-23-19; temporals, 2 + 3 + 4. The head of this specimen is badly mashed.

The species needs no further comparison with other species of the genus, since the zig-zag lateral white line is unique. The closest relative is apparently *Lampropeltis pyromelana.*

UNIVERSITY OF KANSAS, LAWRENCE, KANSAS.

Description of *Salvadora intermedia*, New Species, with Remarks on the *grahamiae* Group

By Norman Hartweg

IN the Mexican herpetological collection of the University of Michigan Museum of Zoology are eight specimens of an undescribed form of the snake genus *Salvadora*. In addition to these are four in the Museum of Comparative Zoology and one in the private collection of Edward H. Taylor. All were collected in the vicinity of Chilpancingo, Guerrero. Since the new form is more or less insulated geographically and since several of its characters are similar to those of other members of the genus, it may be called

Salvadora ***intermedia***, new species

Holotype.—UMMZ[1] No. 85733; male, collected by W. W. Brown in the vicinity of Chilpancingo, Guerrero.

Paratypes.—UMMZ Nos. 85726–32; MCZ Nos. 33642–44; EHT No. 21437.

Diagnosis.—A *Salvadora* differing greatly from those relatives in geographic proximity in the following respects: it has more teeth and fewer ventrals than *bairdii;* fewer teeth, fewer subcaudals, fewer labials and more preoculars than *mexicana;* fewer teeth, fewer subcaudals, fewer ventrals, fewer labials and more preoculars than *lemniscata*.

Description of the Subspecies.—Rostral projecting slightly, its edges free, extending back and separating the internasals for about ½ to ⅔ their length. Upper head shields normal. Anterior nasal in contact with 2nd supralabial. Loreal single, resting on 2nd and 3rd supralabials. Two preoculars, the lower small, wedged between the 3rd and 4th supralabials. Two postoculars, the lower in contact with the 5th supralabial only. Temporals normally 2 + 2 + 3; the upper of the first pair very small, the lower large, in contact with the 5th, 6th, and 7th supralabials, separating the 6th from the postoculars; lower temporal of the second pair in contact with the 7th and 8th supralabials and the lower of the third pair in contact with the 8th supralabial. Supralabials 8, 4th and 5th entering the eye. Infralabials 10, the first pair in contact behind the mental. Two pairs of chin shields, the anterior much larger than the posterior, which are separated by one or more scales; if more than one, they are arranged in tandem.

Dorsal scale rows in the reduction series of 17–15–13, the reduction from 17 to 15 occurring opposite ventrals 100–111 and usually involving scale rows 3 and 4; from 15 to 13 occurring opposite ventrals 103–120 and usually involving scale rows 6 and 7. Ventrals (♂) 175–181; (♀) 172–182. Subcaudals (♂) 102–103; (♀) 97–102.

Maxillary teeth 14 (15 in one) of which 11 (12 in one) are anterior to the diastema.

Head above brown to various shades of grey; somewhat lighter in snout

[1] UMMZ = University of Michigan Museum of Zoology; MCZ = Museum of Comparative Zoology; EHT = Edward H. Taylor, private collection; CAS = California Academy of Sciences.

region; labials creamy white. Middorsal stripe yellowish, three scales wide at the nape, expanding anteriorly toward the parietals and contracting to one or to one and two half scales in width posteriorly on the body; this stripe is continued on the tail where it becomes progressively narrower and fainter. Bordering the middorsal light stripe is a dorso-lateral dark band occupying scale rows 7–6–5–4 and the upper edge of 3 anteriorly, compressed posteriorly to occupy scale rows 4 and 5 and adjacent halves of 3 and 6 to somewhat beyond the midsection; the color becomes progressively lighter on the upper half of scale row 3 and the lower half of scale row 4 resulting, in some of the specimens, in a well defined dark stripe through the third scale row. On the tail the lateral dark band is continued as a narrow stripe or is indistinct. The outer edge of the ventrals and scale rows 1, 2 and part of 3 are lighter than the dorso-lateral band but are darker than the ventral surface, which is creamy white or white faintly tinged with pink.

The distinctness of the color pattern varies greatly in the series examined. In the more melanistic specimens the dark pigment has encroached upon the middorsal light stripe in varying degrees of intensity. The darker the specimen the less distinct is the longitudinal separation of the lateral band anteriorly. Thus a separate dark stripe through scale row 3 in the darkest specimens is scarcely or not at all visible, being merged with or occluded by secondary melanic pigment. Obviously, in the extreme cases no light lateral stripe is apparent. Nevertheless, regardless of the degree of melanism, the dorso-lateral band never extends below the upper half of scale row 3. In other words, the lower edge of the lateral dark stripe is always distinct although the upper is often not differentiated.

Posterior to the lateral and paravertebral scale row reductions the lateral dark stripe occupies the lower $\frac{1}{4}$–$\frac{1}{2}$ of scale row 3 and the lateral light stripe occupies the upper $\frac{1}{2}$–$\frac{3}{4}$ of scale row 3 and the lower $\frac{2}{3}$ of 4. Here again the degree of melanism has an effect on the distinctness of both the lateral light and dark stripes. The lateral dark stripe may be sharply delineated by the light stripe immediately above it and the light area below it in the "normal" specimens or it may not be defined as an entity due to occlusion of the light stripe. When the latter condition prevails the dorso-lateral band is solid, but the ventral boundary extends no lower than the ventral boundary of the dark lateral stripe in the non-melanistic specimens.

There is a regular and an irregular variance in the number of scale rows occupied by the middorsal light stripe. The regular variance is correlative with the paravertebral scale row reduction; the irregular with the degree of melanism. In the non-melanistic specimens the middorsal light stripe is clear, occupying 3 full scale rows anteriorly and the median and adjacent halves of the paravertebrals posterior to the paravertebral scale row reduction. In the darker specimens the middorsal light stripe suffers varying degrees of distinctness, dependent again on the degree of melanism. Anteriorly the middorsal stripe may be 3 scales wide, indistinct, the paravertebrals only slightly lighter than the scales of the adjoining dorso-lateral dark band. Or the contrast to the dorso-lateral dark band may be noticeable only on the median and adjacent halves of the paravertebrals. Posteriorly the stripe may be also affected similarly by the invasion of melanic pigment.

The median row both anteriorly and posteriorly is in all instances the less melanic.

To sum up, then, the area occupied by the dorso-lateral band is affected by primary change in position and by secondary invasion of dark pigment. The latter condition may be detected because the original pattern of the light areas is in some instances still apparent. Melanism has progressed to such an extent that even in the posterior part of the body the lateral dark stripe is scarcely discernible in three specimens and is invisible in three. In the others it is most distinct in the least melanistic specimens. In the dorsal region an unclouded stripe is present in only three specimens.

Herpetological literature contains a number of references to the mechanics of scale row reduction. In *Salvadora,* and probably in many other genera also, it is scarcely more than conjecture to designate specifically which scale rows are "lost" or "dropped" or "fused."

From the neck to about the 106th ventral (average) and from about the 111th ventral to the vent, *S. intermedia* displays 17 and 13 scale rows, respectively. The scale rows of the intermediate region number less than 17 but more than 13. In most instances the first reduction is lateral, apparently involving scale rows 3 and 4. The reduction to 13 is usually dorso-lateral, apparently involving scale rows 6 and 7.

In the lateral reduction, scale rows 2 and 5 undergo little change in size. The scales of rows 3 and 4 may decrease in size progressively and equally or the scales of one of the rows may decrease more than those of the other as the region of reduction is approached. The point of reduction is marked, usually, by an enlarged scale covering an area as large as that occupied by the last scale of both rows 3 and 4 together, the reduction seeming to have been effected by fusion. Rarely does it appear that one of the rows is dropped.

When the dorso-lateral reduction follows the lateral, as it usually does, the scales of row 5 undergo no visible change. In most instances the scales of rows 6 and 7 decrease in size equally or unequally, appearing to eventually fuse to form the 6th row of the reduced series. Frequently, however, the scales of both the paravertebral and the middorsal row at, and immediately beyond, the point of reduction are enlarged, as though row 7 had contributed to both.

REMARKS.—In other forms of the *grahamiae* group, the lateral reduction seems most often to involve scale rows 3 and 4 also. The same variations in progressive decrease of scale size are present. In addition, in a few specimens, the first scale of the reduction is in tandem to the 2nd and 3rd rows, the size of the scales of the 4th row being unaffected. Nevertheless, in *lineata,* the lateral stripe caudad to the lateral scale row reduction occupies the 2nd scale row regardless of the mechanics of reduction. Although the correlation between the pattern and the arrangement of the scale rows is very close, the pattern of any particular scale row depends on its position on the body. Thus, the fundamental position of the pattern seems not to be disturbed by different arrangements of the scale rows.

The dorsal light stripe is as fixed in position as the lateral dark stripe. The change of scale rows occupied, effected by the paravertebral reduction, is

not a change in the fundamental position. The stripe continues in its same relative position as before, its width scarcely, if at all, narrowed. Thus, anterior to the reduction, the stripe may occupy the 3 median scale rows, and posterior to it may occupy the median and adjacent halves of the paravertebrals. This does not signify a sudden change in the width of the stripe in this region, but it does signify a change in the size of the scales. Correlatively, the change in scale rows occupied by other portions of the pattern does not signify sudden change in extent.

With only a slight variation in the comparatively few specimens examined, the essential features of pattern in the *grahamiae* group may be defined as consisting of a mid-dorsal light stripe and an adjoining dark dorso-lateral band. Below the band a lateral stripe may or may not be present.

There is a geographical progression in the position of the dark lateral stripe among the members of the *grahamiae* group. In *intermedia,* the lateral dark stripe is on the upper part of the 3rd row anterior to the lateral scale row reduction, on the lower part of the 3rd row posteriorly. In five specimens fom the plateau of San Luis Potosí (UMMZ 77246–49) the stripe is on the 3rd row anteriorly and on the adjacent fifths of the 2nd and 3rd rows posteriorly. One from Hidalgo (UMMZ 80943) shows the stripe on the 3rd row anteriorly and on the upper part of scale row 2 posteriorly. Three from the vicinity of San Antonio, Texas (UMMZ 57035, 57046, 71924), also have the stripe on the 3rd row anterior to the lateral scale row reduction and on the upper part of the 2nd posteriorly. One (UMMZ 72849) from San Marcos, Texas, near the eastern edge of the range of the genus, exhibits the stripe on the 3rd row anteriorly and on the 2nd and 3rd posteriorly. This is reminiscent of the pattern of the San Luis Potosí specimens. However, more than half the width of the stripe is on the 2nd row.

From near Mimbres, in southern New Mexico, are two specimens (UMMZ 79216–17), one of which has a faint stripe on the 3rd row anteriorly, but no trace of one posterior to the lateral scale row reduction. The other shows no trace of a lateral stripe at all, the color below the dark lateral band being uniform. These specimens, both from exactly the same locality, probably represent intergrades between *lineata* and *grahamiae*. Two from the Davis, one from the Chisos, and one from the Guadelupe Mountains (UMMZ 81979–80, 66022, 70138 respectively), show no trace of the lateral stripe. Two from southeastern Arizona (CAS 34754 and 48060) likewise lack lateral stripes.

Salvadora intermedia seems most closely related to the southern members of the *grahamiae* group. Series from unrepresented areas in Mexico are needed to establish the degree of relationship between *intermedia* and *bairdii*. Likewise the status of the San Luis Potosí population and its relationship to *grahamiae lineata* as well as to *intermedia* and *bairdii* is uncertain. The single specimen from Hidalgo may be a representative of a *grahamiae-bairdii* connection. The position of the first scale row reduction separates *intermedia* absolutely from all forms of the *grahamiae* group which have been examined from north of the Mexican-United States border.

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Amphibians and Reptiles of the Roosevelt Reservoir Area, Arizona

By Elbert L. Little, Jr.[1]

A COLLECTION representing seven species of amphibians and thirty-three species of reptiles (sixteen of lizards and seventeen of snakes) was made in the Roosevelt Reservoir area in Gila County, central Arizona, during the years 1936 and 1937 by the author as a spare-time study.

One species, *Leptotyphlops myopica,* has not previously been reported from the state. The specimens of *Rana tarahumarae* probably constitute the second Arizona record of this species and extend the known range about 165 miles north from the first station in Santa Cruz County, on the Mexican border. A few additional distribution records within the state are included, and more than half of the species have not been reported previously from Gila County.

Less collecting of amphibians and reptiles has been done in Gila County than in most sections of Arizona. No military forts of importance were located here, and this area was not on routes of early exploring expeditions. Present-day herpetologists have been more interested in the rich collecting areas along the Mexican boundary. In summarizing records of Arizona amphibians, Slevin (1928) cited no records from Gila County. Van Denburgh (1922) in a similar compilation of Arizona reptiles mentioned fourteen species from Gila County, of which two are not represented also in the author's collection. They are: *Crotaphytus wislizenii,* from the Gila River, and *Thamnophis angustirostris,* from Tonto Creek at an elevation of 6,000 feet. Van Denburgh cited three species from Roosevelt Reservoir and vicinity: *Callisaurus v. ventralis, Heloderma suspectum,* and *Cnemidophorus melanostethus.* From Sierra Ancha, also the author's collecting base, Van Denburgh listed five species: *Crotaphytus collaris baileyi, Sceloporus consobrinus, Phrynosoma douglassii hernandesi, Coluber t. taeniatus,* and *Lampropeltis pyromelana.* The remaining four species of other localities in Gila County were: *Uta ornata symmetrica, Phrynosoma solare, Micrurus euryxanthus,* and *Crotalus atrox.* Gloyd (1937) listed specimens of four species from Gila County, collected by Earl Sanders. Only one of these, *Crotalus m. molossus,* from 3 miles north of Roosevelt Dam, was not cited by Van Denburgh.

Roosevelt Reservoir, an artificial lake formed by Roosevelt Dam, is located at the union of Salt River and Tonto Creek within the Tonto National Forest in Gila County about 30 miles, by air line, northwest of Globe. In a natural basin at an elevation of about 2,100 feet, Roosevelt Reservoir is surrounded on all sides by steep, rough mountainous topography. The highest elevation in this vicinity is about 7,800 feet on Sierra Ancha, less than 20 miles northeast.

Collections were made on the watershed north and east of Roosevelt Reservoir within a 20-mile radius of the dam. Base for collecting was Sierra

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Ancha Experimental Forest of the Southwestern Forest and Range Experiment station, with headquarters at an elevation of about 5,000 feet on the southwest side of Sierra Ancha about 15 miles northeast of Roosevelt Dam. The various tanks, pits, plots, dams, etc., constructed at typical places on the watershed for research in forest influences, such as measurement of run-off, erosion, and stream flow, served as excellent traps for amphibians and reptiles. Most of the specimens, including those of a few species which otherwise might not have been represented, were captured alive in these research installations. A few important specimens were found dead on roads, where they had been run over by automobiles. Firearms were not used.

Variation of more than a mile in vertical elevation results in the presence of three zones of vegetation and a rich representation of amphibians and reptiles for the size of the area. These zones are: (1) semidesert, or Lower Sonoran, from Roosevelt Reservoir to an elevation of about 3,500 feet; (2) chaparral-woodland, or Upper Sonoran, roughly from 3,500 to 6,000 feet; and (3) pine-fir forest, or Transition, above 6,000 feet. With higher elevation temperature decreases, precipitation increases, and numbers of cold-blooded land vertebrates become fewer.

The semidesert zone is characterized by scattered xerophytic shrubs and trees with weeds and grasses among them. Dominant woody plants include jojobas or "coffeeberries" (*Simmondsia californica*), paloverdes (*Cercidium* spp.), and cacti (*Opuntia* spp.). Lizards and snakes are especially abundant in this hot, semiarid zone. Among the characteristic species here are: *Coleonyx variegatus, Holbrookia texana, Heloderma suspectum, Cnemidophorus melanostethus, Salvadora grahamiae hexalepis,* and *Crotalus a. atrox.*

Chaparral vegetation of broad sclerophyll shrubs with some open areas occupied by perennial grasses is common in the chaparral-woodland zone. Dominant chaparral species are shrub live oak (*Quercus turbinella*), mountain-mahogany (*Cercocarpus breviflorus*), and Gregg hornbush (*Ceanothus greggii*). On the more moist sites are oak woodlands of broad sclerophyll trees, in which Emory oaks (*Quercus emoryi*) and Arizona white oaks (*Quercus arizonica*) are dominant. Characteristic species of reptiles of the chaparral-woodland zone include: *Uta ornata symmetrica, Cnemidophorus perplexus, Eumeces obsoletus, Coluber t. taeniatus, Pituophis sayi affinis, Crotalus m. molossus,* and *Crotalus viridis oreganus.*

The pine-fir forest has as its dominant species ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga taxifolia*). Among the few species of amphibians and reptiles of this zone are: *Hyla arenicolor, Sceloporus u. consobrinus,* and *Lampropeltis pyromelana.*

Several genera of lizards and snakes are represented by different species in the semidesert zone from those of the higher zones. Examples typical of the semidesert zone include: *Uta stansburiana stejnegeri, Sceloporus magister, Phrynosoma solare, Cnemidophorus melanostethus, Coluber flagellum frenatus, Lampropeltis getulus yumensis,* and *Crotalus a. atrox.* Corresponding species of the same genera in higher zones are: *Uta ornata symmetrica, Sceloporus clarkii, S. u. consobrinus, Phrynosoma douglassii hernandesi, Cnemidophorus perplexus, Coluber t. taeniatus, Lampropeltis pyromelana, Crotalus viridis oreganus,* and *C. m. molossus.*

Although no attempt was made to collect large series of specimens, several were taken of most species. Specimens of every species listed except *Gerrhonotus kingii* were collected personally by the author. Credit is due various members of the personnel of Sierra Ancha Experimental Forest for assistance in collecting additional specimens. A complete set of specimens was deposited in the United States National Museum, and duplicates were retained at Sierra Ancha Experimental Forest. For checking and correcting his preliminary field determinations, the author is indebted to Drs. Leonhard Stejneger, Doris M. Cochran, and Hobart M. Smith, of the United States National Museum.

The list of species with notes and zonal distribution follows. Nomenclature is that of Stejneger and Barbour's (1939) checklist.

Scaphiopus couchii Baird. — A mating pair was found in water in a run-off tank July 8, 1936, following the first summer rain. Tadpoles are common in temporary pools in the semidesert after these summer rains.

Bufo alvarius Girard.—Two giant toads were collected at Grapevine Spring on Roosevelt Reservoir, semidesert zone.

Bufo punctatus Baird and Girard.—Four were caught at night May 16, 1937, in a creek, semidesert zone, where they were located by their call, a shrill bleat.

Bufo woodhousii Girard.—Three were obtained at night May 16, 1937, in Tonto Creek, semidesert zone, where they were found by their coarse croak.

Hyla arenicolor Cope.—Common in the pine-fir and chaparral-woodland zones but uncommon in the semidesert. Calling individuals and clasping pairs were common in water at a dam in the pine-fir forest on May 19, 1936. After the mating season adults are found occasionally around buildings.

Rana pipiens Schreber.—In small streams. One was collected in the semidesert zone but not preserved, and another was seen in the pine-fir zone.

Rana tarahumarae Boulenger.—A series of 22 specimens was taken out of about 100 observed in pools of water shaded by alders and sycamores along Rose Creek, elevation about 5,400 feet, at the lower border of the pine-fir zone, on August 22, 1936. This record probably is the second Arizona locality of this species of Chihuahua, southern New Mexico, and Arizona. Campbell (1931) previously collected specimens at Peña Blanca Springs in Santa Cruz County, near the Mexican border. The author saw a few adults and tadpoles at a spring in Bear Valley a few miles west of Peña Blanca Springs on May 15, 1938.

Coleonyx variegatus (Baird).—Common in the semidesert zone and rare in the chaparral-woodland zone. Several were collected in pits in the ground and in buildings at experimental plots, where more were trapped and seen frequently. Rarely found hiding under rocks.

Crotaphytus collaris baileyi (Stejneger). Three were captured in the chaparral-woodland zone and two in the semidesert zone.

Callisaurus ventralis ventralis (Hallowell).—Three were taken in the semidesert zone.

Holbrookia texana (Troschel).—Common in semidesert and uncommon in chaparral-woodland zone. Associated with lizards of the preceding species, which they resemble superficially.

Uta ornata symmetrica (Baird).—Abundant on ground and on tree trunks, chaparral-woodland zone. Young hatch early in August from eggs laid in experimental pits in the ground.

Uta stansburiana stejnegeri Schmidt.—Several were collected in pits in the ground in the semidesert.

Sceloporus clarkii clarkii Baird and Girard.—Resembling lizards of the species *S. magister*, these lizards are found in the chaparral-woodland zone on trunks of oak trees and on the ground.

Sceloporus magister Hallowell.—These swift, large lizards are common in the semidesert zone.

Sceloporus undulatus consobrinus (Baird and Girard).—On ground and tree trunks, but much less numerous than individuals of *Uta ornata symmetrica*. Chaparral-woodland and pine-fir zones. One was collected in an aspen forest also.

Phrysonoma douglassii hernandesi (Girard).—Common in chaparral-woodland and pine-fir zones.

Phrynosoma solare Gray.—Four were collected in the semidesert.

Gerrhonotus kingii Gray.—Seven of these infrequently collected lizards were taken in the chaparral-woodland and pine-fir zones at elevations from 5,000 to 7,000 feet. The specimens extend the range north into central Arizona.

Heloderma suspectum Cope.—These large, poisonous lizards are rarely run over and killed by automobiles on roads and infrequently collected alive. One young specimen 6½ inches long was taken alive on a road after sundown May 25, 1936. Semidesert zone up to the lower border of the chaparral-woodland zone at an elevation of about 4,000 feet. Vorhies (Shantz, 1936: 97–99) has emphasized that no person has ever been bitten by a Gila monster unless he was handling it carelessly. These unique, slow-moving lizards are harmless in the desert and should be left alone and protected by law and public sentiment. As Vorhies states, if this species were exterminated, we would be the losers.

Cnemidophorus melanostethus Cope.—Common in semidesert and uncommon in chaparral-woodland.

Cnemidophorus perplexus Baird and Girard.—Common in chaparral-woodland and uncommon in semidesert.

Eumeces obsoletus (Baird and Girard).—Uncommon on the ground, usually around leaf litter, in chaparral-woodland zone. Both adults and the black, blue-tailed young were taken.

Leptotyphlops myopica (Garman).—This species of worm snake is not included in the list of Arizona reptiles and amphibians by Slevin (1934). Recent extension of the range to Arizona by Stejneger and Barbour (1939) is based upon the specimens from the Roosevelt Reservoir area here recorded. Three were collected, one in 1935, one July 26, 1936, and one August 2, 1936, in run-off tanks in chaparral vegetation at an elevation of about 5,500 feet. They may have been washed into the tanks in heavy rains.

Coluber flagellum frenatus (Stejneger).—One was found dead on a road in the semidesert.

Coluber semilineatus (Cope).—Three specimens were collected in the semidesert and chaparral-woodland zones.

Coluber taeniatus taeniatus (Hallowell).—Common in chaparral-woodland. Often climbing in shrubs.

Salvadora grahamiae hexalepis (Cope).—Common in semidesert and chaparral-woodland.

Pituophis sayi affinis (Hallowell).—Common in chaparral-woodland and semidesert. One more than 6 feet long was the largest snake collected here. Johnson (1936) has described a fight between a gopher snake, or bull snake, and a coyote on Sierra Ancha, in which the coyote killed and ate the snake.

Lampropeltis getulus yumensis Blanchard.—Four were collected in the semidesert.

Lampropeltis pyromelana (Cope).—Common in chaparral-woodland and pine-fir forest.

Rhinocheilus lecontei Baird and Girard.—The only specimen was found dead on a road in the semidesert.

Thamnophis eques (Reuss).—Near water, chaparral-woodland and pine-fir zones.

Thamnophis ordinoides vagrans (Baird and Girard).—Around water, semidesert, chaparral-woodland, and pine-fir zones.

Hypsiglena ochrorhynchus Cope.—Four were taken in semidesert and chaparral-woodland zones.

Tantilla atriceps (Günther).—Two were collected in the chaparral-woodland zone. One was in a run-off tank, while the other was found hibernating in gravel along a road bank December 24, 1936.

Micruroides euryxanthus (Kennicott).—One was caught in a run-off tank near the upper border of the semidesert zone. These poisonous snakes are very rarely found here.

Crotalus atrox atrox (Baird and Girard).—Very numerous in the semidesert, where they reach a maximum length of about 5 feet. Many are run over and killed by automobiles on roads about sunset. Both typical specimens and those also segregated under *Crotalus scutulatus* (Kennicott) were collected. Klauber (1930) cited specimens of the two forms from Gila County, including *C. atrox* from Roosevelt Reservoir.

Crotalus molossus molossus (Baird and Girard).—Common in chaparral-woodland and pine-fir zones. Sometimes found around buildings.

Crotalus viridis oreganus (Holbrook).—Common in chaparral-woodland. Very young rattlesnakes are light gray with dark brown blotches, but all adults observed here are black except for narrow patterns of pink scales.

A few additional species have been reported reliably by foresters and others in the Roosevelt Reservoir area but are not represented in the author's collection. Chuckwallas (*Sauromalus obesus*) have been seen by several persons among granite boulders along Salt River above Roosevelt Reservoir. The author saw one about 25 miles southwest of the dam. Horned rattlesnakes or sidewinders (*Crotalus cerastes*) have been reported from Tonto Basin, north of Roosevelt Dam.

Mud turtles (*Kinosternon* sp.) are not uncommon in Roosevelt Reservoir

and Sallymae Creek, but attempts to get specimens were not successful. One land turtle of an uncertain species was caught on Sierra Ancha in 1938 and two others were reported previously. Land turtles probably are very rare in this area. Tiger salamanders (*Ambystoma tigrinum*) occur only a short distance away and are to be looked for, and western spadefoots (*Scaphiopus hammondii*) are to be expected here also.

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Herpetological Notes

DELAYED HATCHING IN THE SNAPPING TURTLE.—On a small, rocky island of Ashby Lake, Ashby Township, Lennox and Addington County, Ontario, 22 newly hatched snapping turtles, *Chelydra serpentina*, were unearthed on May 12, 1940. They were buried about 6 inches deep in light sandy soil, were apparently of one clutch and were alive, though not active since the temperature was near freezing. In a previous note (Copeia, 1933: 221), I suggested that snapping turtles may be delayed in their hatching, sometimes taking nearly a year to break from the earth. In the present case the eggs must have been deposited the previous year, for Ashby Lake was still ice-covered on May 5, 1940. Snapping turtles, near the northern edge of their range, can apparently remain over the first winter in the soil of the nesting site. This observation parallels Newman's report of over wintering in the eggs for *Graptemys geographica* (Newman, H. H., 1906, Jour. Comp. Neurol. Psychol., 16: 141).—G. C. Toner, *Cataraqui, Ontario, Canada*.

SIZE AND WEIGHT OF A BOA CONSTRICTOR.—A specimen of *Constrictor constrictor constrictor* (Linné) died in the Pittsburgh Zoological Garden on March 10, 1940, after almost four years in captivity. A post-mortem examination, on March 12, did not succeed in establishing the cause of death. Although the snake may have lost a little weight by the time it was examined it was still sufficiently fresh to yield fairly accurate figures regarding its size and weight. Since relatively little information of this type is available for large snakes the following records may be of interest.

The specimen was a female, with 69-87-47 dorsal scale rows, 243 ventrals, and 55 caudals. In the flesh it had a head-body length of 2095 mm., and a tail length (tip missing?) of 225 mm. (total length, 8 ft.). The maximum circumference, at a point posterior to mid-body, was 280 mm., and the circumference of the tail immediately behind the vent was 111 mm. The anal spurs were 4.5 mm. in length.

The following figures (avoirdupois weights converted to metric equivalents) are accurate to within 0.1 kg.: gross weight, 8.165 kg. (18 pounds); carcass after removal of skin and viscera, 4.6 kg.; skin and viscera, 3.5 kg. Other weights were obtained with a metric balance, as follows: freshly removed skin, 1536 g.; fat, 811 g.; liver, 264 g.; heart, 35 g.; remaining viscera (by subtraction), 870 g. The digestive tract was empty except for a small quantity of fecal matter in the rectum. A number of small, non-parasitic cysts were found under the skin, in the esophagus, and around the myocardium; no macroscopic parasites were found; the lungs contained a little stringy mucus; and the mucous membrane of the mouth was slightly inflamed.—M. GRAHAM NETTING, *Carnegie Museum, Pittsburgh, Pennsylvania.*

ANOLIS CAROLINENSIS EATEN BY *EUMECES LATICEPS*.—An adult male *Anolis carolinensis* Voigt that was accidentally transported to Pittsburgh in a shipment of Florida tangerines was stiff with cold when found on December 20, 1939, but it became quite active when transferred to a warm room. In January, 1940, when placed in a cage containing an adult *Eumeces laticeps* (Schneider) that was approximately 105 mm. in head-body length, the anole spread its throat-fan and assumed a defensive posture, although the skink evinced no interest. The following morning, however, the skink was seen with its jaws clamped tightly across the head of the anole; the latter was motionless with the long axis of its body forming a right angle with that of the skink. My observations were briefly interrupted, but the subsequent disappearance of the anole and the swollen condition of the skink testified to the outcome. The *Eumeces*, a Florida specimen received in May, 1939, had previously subsisted entirely upon meal worms, and had avidly eaten from one to two dozen of these each week. Taylor (1935, Kans. Univ. Sci. Bull., 23: 62), reports instances of several species of *Eumeces* feeding upon other lizards, but does not list *Anolis* as an item of prey. In view of the arboreal proclivities of *E. laticeps* and its custom of searching bark crevices for insects, it may be assumed that anoles constitute a portion of its natural food in areas where both species occur.—M. GRAHAM NETTING, *Carnegie Museum, Pittsburgh, Pennsylvania.*

EUMECES EGREGIUS IN GEORGIA.—As far as I have been able to ascertain, the only Georgia records of *Eumeces egregius* (Baird) are from Charlton County, not far north of the Florida boundary. The presence of this form as far north as Richmond County, in east-central Georgia, is therefore of considerable interest.

While collecting on March 3, 1939, near Lake Ormond, about 4 miles west of Augusta, I found two adult specimens of this species beneath some scattered wood-chips. A third individual was seen, but not taken, about a mile farther west. On March 23, 1939, Mr. I. G. Ricker, Jr. captured another *Eumeces egregius* at DeBruce, Georgia; and shortly thereafter at the same spot (near a deserted saw-mill site) I found another one. The Lake Ormond and the DeBruce localities are fully a dozen miles apart. Both are open areas of sandy soil unsuited to any of the other Georgia lizards, except *Cnemidophorus sexlineatus*.

I doubt the possibility of the introduction of the species at two such separated, comparatively uninhabited sections. *Eumeces egregius* probably exists normally this far to the north, but only in a few scattered colonies. On account of its scarcity, small size, and secretive habits, it may readily have been overlooked.—WILFRED T. NEILL, JR., *Augusta, Georgia.*

Ichthyological Notes

AN AMERICAN CYPRINODONT FISH, *JORDANELLA FLORIDAE*, REPORTED FROM BORNEO, WITH NOTES ON THE POSSIBLE WIDESPREAD INTRODUCTION OF FOREIGN AQUARIUM FISHES.—The extent of the tropical aquarium fish import business, at least up until the outbreak of the present war in Europe, has not been realized by most ichthyologists. Even those few who attempt to keep up with part or all of the many domestic and foreign aquarium journals cannot realize the wealth of small fishes, mostly fresh-water but in late years partly marine, that have been shipped alive from the tropics to Europe and America. The journals usually report only part of the species brought in, and scores if not hundreds of imported species have never been mentioned in the literature. Few of these are bred and maintain themselves on the market, but they are usually re-imported from time to time.

The enormous growth of the aquarium fish hobby in the eastern United States, coinciding almost exactly, in its rise and slow fall, with the slump and the gradual recovery from financial depression (1929–present), gave a prodigious impetus to the import trade in tropical fishes. And although this trade had slackened in the eastern states, the impetus made itself felt in all civilized parts of the world, especially in Germany, which has always been the center of tropical fish trade. The hobby caught on in England as it never had before, and aquarium societies interested chiefly in tropical fishes were formed even in China. Statistics of the import trade have never been compiled, but the aggregate money involved must have been enormous.

The possible effect of this indiscriminate shipping about of live fishes on fish distribution has scarcely been considered by ichthyologists. The shipments have not been entirely one-way. Aquarium-bred specimens of tropical American species have frequently been carried as return cargo to Singapore, and such transfers must be fairly common. One instance may serve as an example. Several years ago I saw in San Francisco some live *Mollienisia* (of a form entirely unknown to me but probably a subspecies of the Central American *M. sphenops*) that had recently been received direct from Manila.[1] They were said to have become established in at least one place on or near Manila Bay. Later I learned more of this fish from Dr. A. W. Herre. He told me that a German physician interested in aquarium fishes had brought them to Manila, and that this man obtained them in Egypt!

The genesis of the present note was a brief notice by my correspondent, Mr. J. Paul Arnold, the eminent German authority on aquarium fishes, in the *Wochenschrift für Aquarien- und Terrarienkunde* (35, 1938: 607). In it he calls attention to the presence of examples of *Jordanella floridae* in a shipment of live fishes just arrived from the East Indies. The collector, Mr. Carl Griem (who has, to my own knowledge, transported more live fishes than any other living person), said he obtained them in Borneo, no exact station being mentioned in Arnold's notice. The record is certainly open to question on several counts. Fishes in aquaria, either awaiting shipment or after arrival, are easily mixed, and practically all aquarium fish shipments from the whole Malayan region clear through Singapore. On the other hand, the collector is a competent person, very familiar with aquarium fishes, who apparently recognized the *Jordanella* as such when he got them, and questioned Mr. Arnold in regard to such a strange find when he arrived in Hamburg. That Mr. Arnold is fully as competent to identify *Jordanella* as almost any ichthyologist, is unquestionable. The fish has been known to German aquarists a long time.

There have doubtless been many introductions that have not been discovered or reported, and likewise a number that have been reported but about which I do not know. Several are known to me through hearsay. Some of the largest American breeders of tropical aquarium fishes are located in Florida, and I have heard of several instances (one

[1] They had a high but much shorter dorsal than *M. latipinna*, which is now common in salt-ponds about Manila Bay, and the male closely resembled (in appearance and size) the unnamed *Mollienesia* figured in 1914 by Karl Stansch (Die exotischen Zierfische in Wort und Bild, Braunschweig: 212). I have examined Manila Bay examples of *M. latipinna* collected by Dr. Herre and they are exceedingly unlike this strange other form.

from the operator himself) of rains flooding the breeding ponds and washing miscellaneous stock into nearby rivers. Word-of-mouth reports have it that the Chinese *Macropodus opercularis,* and the Mexican *Platypoecilus maculatus* and *Xiphophorus hellerii* are breeding in the Everglades. Another rumor is that *Macropodus* and other fishes are now acclimated and spreading in the Lower Amazon about Belém (Pará). I have had two or three persons tell me that *Xiphophorus, Platypoecilus, Lebistes* and other exotic fishes are now inhabiting streams in the Hawaiian Islands.[2] Several years ago I noticed in a German journal an illustration of a *Gambusia* recently brought up from Spain and if the illustration was at all correct the fish must be some form related to *G. senilis.* Other hearsay reports mention the introduction of foreign aquarium fishes into the waters of West Africa, Panama, and the Malay Peninsula. I have no doubt that certain of these reports have no foundation, but some of them must be true.

Of course, the wide distribution of *Gambusia, Lebistes,* and other fishes in anti-mosquito work is well known, and some of the introductions are probably traceable to some such source. But ichthyologists are certainly in for some strange distributional records, and it is to be hoped that immediate notice of them will be published.—George S. Myers, *Natural History Museum, Stanford University, California.*

NOTE ON THE YOUNG OF THE SABLEFISH, *ANOPLOPOMA FIMBRIA.*[1]—During an oceanographic cruise of the "E. W. Scripps" in May, 1939, off the coast of Oregon, four small, post-larval specimens of *Anoplopoma fimbria* were taken at the surface of the sea with a dip net at two of the hydrographic stations off Cascade Head, Oregon; and others were observed while cruising between these stations, and at a third station farther offshore and to the south. The first two stations were at Lat. 44°–54′ N., Long. 126°–20′ W., and Lat. 44°–46′ N., Long. 128°–22′ W., respectively, the former (F. 31), being about 100 miles offshore and the second (F. 33), 185 miles offshore. The water temperature at the surface was 13.75° Centigrade at F. 31 and 11.84° at F. 33. These stations were occupied on the 23rd and the 25th of May, 1939.

The four specimens obtained were from 21 mm. to 35 mm. in standard length and differed most strikingly from adult *Anoplopoma* in coloration and in the relative size of the pectoral fins. In the smaller examples the tip of the pectoral extends back as far as the insertion of the soft dorsal and is one-third the standard length of the fish, as may be seen from Table 1, in which are recorded measurements of three adult specimens for comparison.

Table 1.—Comparison of Pectoral Length with Standard Length

Standard length	Pectoral length	Ratio SL/PL	Locality of Capture
418 mm.	77 mm.	5.4	Off Southern California, 158 fathoms
224 mm.	36 mm.	6.2	Marshfield, Oregon
65 mm.	14 mm.	4.6	Monterey Bay
35 mm.	11 mm.	3.2	St. F. 33 Cascade Head, Oregon
29 mm.	9 mm.	3.2	St. F. 31 Cascade Head, Oregon
22 mm.	7.3 mm.	3.0	St. F. 33 Cascade Head, Oregon
21 mm.	7 mm.	3.0	St. F. 33 Cascade Head, Oregon

In life, the dorsal surface of the young fish is blue to blue-green, blending into bright silvery on the ventral surface. The pectoral fins are colorless, the distal half largely black; the other fins are also colorless. Gilbert (1915), in describing a specimen 75 mm. long from Monterey Bay, mentions that the anterior dorsal rays and the caudal are largely black. This is not true of these smaller specimens. In preservative the dorsal surface is pigmented, the myotomes are marked by dark chromatophores, and the upper part of the eyeball is also spotted with dark chromatophores. The eye is blue-green in color, much as it is in life. The ventral surface in the midsection between the ventral fins and the anal is spotted with pigment; elsewhere, aside from a few spots, it is immaculate. The head is shaped much like that of an adult fish; but, of course, the eye is proportionally much larger. Also, the mouth is inclined upwardly from the longitudinal axis of the fish instead of being almost parallel with it as it is in the adult. As a result, in

[2] One verbal report is that some of these fishes were liberated by the overflowing or flooding of pools belonging to Mr. C. Montague Cooke, Jr., of Oahu.

[1] Contribution No. 4 from Fish Commission of Oregon.

specimens of less than 25 mm., the angular projects slightly at the junction with the interopercle, while the angle formed by this junction is much more acute than in a fish 35 mm. long, a condition which obtains in many species of fishes. The body is slender, shaped much like that of the adult fish.

All examples observed were close enough to the surface to break water occasionally while swimming. Gilbert (1915, Proc. U. S. Nat. Mus., 48: 305, 380) notes that the 75 mm. specimen from Monterey Bay examined by him was taken at the surface also. These young fish seemed to be very abundant at the station where they were taken, but due to their excellent protective coloration, could be seen only while moving, and it was necessary for the observer to keep his attention fixed on a specimen once spotted, for even a momentary lapse would lose it. When the young *Anoplopoma* attempted to swim as rapidly as possible, the large pectorals were folded close to the body. Though they were often extended while the fish was swimming slowly, they were apparently not used directly in swimming. They may help keep the fish at the surface of the sea. With growth there is a great reduction in the relative size of the pectoral fins, as shown by Table 1, and perhaps the transition from large to small pectorals marks the transition from habitat at the surface to one below the surface.

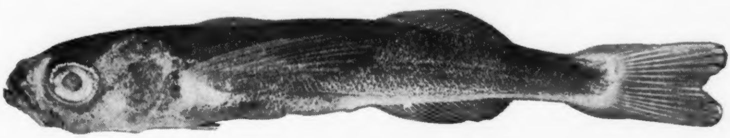

Fig. 1. Young *Anoplopoma fimbria*

It may be noted that adult *Anoplopoma fimbria* are often taken on the bottom in fairly shallow water—usually less than 100 fathoms, and commonly 20 or 30 fathoms. The existence of the young at such distance offshore, in depths of 1540 fathoms, is therefore remarkable. Aside from the single specimen examined by Gilbert from Monterey Bay, there are no records of the young of *Anoplopoma* occurring in waters where the adults may be taken. Furthermore, Gilbert's specimen was twice as long as those taken off Cascade Head and occurred in a region not far from deep water. During the present cruise of the "E. W. Scripps" an excellent opportunity was afforded to observe whether or not young *Anoplopoma* occurred at any of the northern inshore stations. None were noted.

It is possible that those observed from the "E. W. Scripps" had drifted offshore from a normal nursery ground nearer the coast. The direction of surface water transport would be away from the land during periods of prevailing northwesterly winds, and as may be seen from Table 2, the prevailing winds as observed from coastal stations, both north and south of Cascade Head, were northwesterly or northerly for the spring of 1939.

TABLE 2.—PREVAILING WIND DIRECTION 1938–1939[2]

	December	January	February	March	April	May
Newport	E	SE	SE	N	N	N
Astoria	SW	SW	SW	NW	NW	NW

[2] Data relative to prevailing winds supplied through the courtesy of the Portland, Oregon Weather Bureau Office.

Should the prevailing winds offshore not blow from the same quarter as those inshore, then the adults may have spawned farther offshore than the place where the young were observed; furthermore, the abundance of these small fish at the offshore stations, when considered in the light of their apparent absence inshore at all times, gives some weight to the possibility that they were taken in a normal situation. If such be true, then these fish could be expected both to survive and to reappear later in places where the adults normally occur.

Where there is an offshore wind drift, there is usually an inshore counter current at a depth between 100 and 200 meters, as shown by Sverdrup (1937–38, Journ. Marine Research, 1, No. 2) for similar conditions off Port San Luis. Hence, even with a strong seaward drift, it would be possible for the young to find their way shoreward in the comparatively shallow depth of 200 meters or less; but in this case such conditions of drift would have to extend seaward for 100 to 200 miles. Of course, the precise role played by off- and onshore drifts and their fluctuations in the life history of *Anoplopoma*, depends upon the time and place of spawning, whether or not the nursery grounds are offshore, and whether the young observed offshore from the "E. W. Scripps" were in a normal situation and could be expected to survive. The capture of these youthful fish with their large pectoral fins—in all probability an adaptation for living at the surface—at such distances offshore, hints at an unusual and very interesting life history, the details of which will only be revealed with clarity by much more additional information.—VERNON E. BROCK, *Fish Commission of Oregon, Portland, Oregon.*[3]

THE PACIFIC SAURY, *COLOLABIS SAIRA* BREVOORT FROM THE NORTH PACIFIC OCEAN[1].—While on my way to the South Pacific Islands, during April, 1939, I was fortunate in collecting the young of *Cololabis saira* Brevoort between San Diego and the Hawaiian Islands. A single specimen 27 mm. standard length was obtained by use of a submarine light and a dip net April 4, 1939, at 27°02′30″ North latitude, and 132°51′ West longitude (field number U-39-4; U.S.N.M. number 115202). Four additional specimens, 30; 30.3; 32; and 35.5 mm. were taken by the same methods April 7, 1939, at 22°24′ North latitude, 144°53′ West longitude (field number U-39-5, U.S.N.M. number 115201).

The records in mid-ocean between San Diego and the Hawaiian Islands substantiate Hubbs conclusion in 1916 (Hubbs, Univ. Calif. Pub. Zool., 16 (3), 1916: 157) that *C. brevirostris* from California and *C. saira* from Japan are the same species. More recently Schultz, Hart and Gunderson (COPEIA, 1932: 66–67) and Pritchard (COPEIA, 1933: 103–104) report the Pacific saury as occurring off British Columbia. Aplin (Calif. Fish and Game, 25 (4), 1939: 345–346) states that the species is common off southern California.

Mititaka Uda (Bull. Jap. Soc. Sci. Fish., 5 (4), 1936: 236–238) and Takeo Miyauti (*Ibid.*, 5, (6), 1937: 372–374) indicate that an extensive fishery is operated on this species in Japan.

Syûya Nakamura's (Jour. Imper. Fish. Inst., 32, (1), 1937: 17–21) recent paper describing the young stages of *Cololabis saira* from Japanese waters shows that the postlarval stages of this species are pelagic near the surface of the sea.

These records of occurrence on both sides of the North Pacific ocean are now brought closer together by the specimens collected by me far out in the Pacific, and indicate more conclusively that *C. brevirostris* and *C. saira* are one species and will be found to range widely throughout the North Pacific Ocean.—LEONARD P. SCHULTZ, *United States National Museum, Washington, D. C.*

RHINICHTHYS BOWERSI FROM WEST VIRGINIA A HYBRID, *RHINICHTHYS CATARACTAE X NOCOMIS MICROPOGON*.—Four specimens of a hybrid minnow, *Rhinichthys cataractae* x *Nocomis micropogon*, were collected in Cheat River at Cheat Bridge, Randolph Co., West Virginia, on June 25, 1935. A recent examination of the type of *Rhinichthys bowersi* Goldsborough and Clark (Bull. U. S. Bur. Fish., 27, 1908 (1907): 36) in the United States National Museum (U. S. N. M. 61576) revealed this nominal species to be identical with the above mentioned hybrid. These hybrids appear intermediate in most characters such as general body shape, shape of snout as viewed from the side, thickness of the upper lip, number of lateral line scales and density of pigmentation of the dark lateral band. Some of these characters are portrayed in the illustration of the type of *Rhinichthys bowersi* (Goldsborough and Clark, *loc. cit.*). Upon first glance the hybrids are more likely to be identified as *Rhinichthys cataractae* since the fleshy upper lip resembles that of *cataractae* although it is not nearly as well

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[3] I wish to thank Mr. O. E. Sette of the U. S. Bureau of Fisheries and the Scripps Institution of Oceanography for the privilege of making this voyage on the "E. W. Scripps" and for permission to publish on the small *Anoplopoma* that were taken.

[1] Published with the permission of the Secretary of the Smithsonian Institution.

developed. However, the larger scales of the hybrid separate it at once from *cataractae*. Three hybrids from Cheat River now in hand have 49, 50 and 53 lateral line scales while *cataractae* from the same locality has from 60 to 67 and *Nocomis micropogon* has from 39 to 42. Goldsborough and Clark (1908: 36) recognized the intermediate character of *Rhinichthys bowersi* and mentioned that although in form of mouth it resembled *R. cataractae*, its scales were too large for *cataractae*. Dr. Carl L. Hubbs has also studied the type of *Rhinichthys bowersi* and agrees that it is a hybrid.

The hybrids probably resulted from a fortuitous fertilization as *Rhinichthys cataractae* spawned over a nest of *Nocomis micropogon*. Conditions were unusually good for such a chance occurrence in Cheat River at Cheat Bridge, the locality where a cotype and my 4 specimens were collected. A large population of *Nocomis* and a moderately large population of *R. cataractae* were present, although the spawning season for both appeared to have passed by June 25, 1935. Of the other species, *Rhinichthys atratulus obtusus* was probably third in rank of abundance and some individuals of *Hypentelium nigricans*, *Semotilus a. atromaculatus*, *Notropis rubellus*, *Hadropterus oxyrhynchus* and *Cottus b. bairdii* were taken. Many pebble nests of *Nocomis* were present in the shallow riffles where *Rhinichthys cataractae* were found. The nests of *Nocomis* undoubtedly made a good spawning site for *R. cataractae* since the latter species is known to spawn over gravel in a strong current (Greeley, Suppl. 22nd Ann. Rept. N. Y. Cons. Dept., 1933 (1932): 94–95). With many individuals of these two species present in the same area at the same time it is not difficult to visualize them both spawning in close proximity, especially as it is well known that a male *Nocomis* (Raney, Zoologica, 25, 1940: 7) may be quite tolerant of the presence of other fishes over his nest at the breeding time.—Edward C. Raney, *Department of Zoology, Cornell University, Ithaca, New York.*

NOTES ON THE OCCURRENCE OF ALBACORE (*GERMO ALALUNGA*) IN THE NORTH PACIFIC.—On August 1, 1939, Capt. Sverre Johansen of the halibut vessel "Mitkof," returning to Seattle from the Western fishing banks, caught an albacore about 90 miles southwest of Queen Charlotte Sound. The specimen was taken on a feathered tuna lure approximately 25 miles magnetic south of Dellwood Hills, or at a position of Lat. 50°–24′ N., Long. 131°–10′ W. This is approximately 100 miles west of Cape Scott on the northern tip of Vancouver Island and 165 miles north of Destruction Island, the previously reported northern range of this species on the Pacific Coast. The specimen weighed 18½ pounds in the round, and measured 28½ inches to the caudal peduncle, or about the same size and weight as the average of albacore taken off the Washington and Oregon coasts during the latter part of the summer of 1938.

Since the "Mitkof" dragged but one lure and did not alter its course or speed of 8¾ knots, it is not known whether the specimen taken was from a school of albacore or a stray fish out of its normal range.

On August 20, 1939, the halibut vessel "Brisk," returning to Seattle from the Western fishing banks, encountered a school of albacore about 140 miles magnetic west of Cape St. James. Three fish were taken on the single tuna lure which the vessel was dragging at the time. A fourth fish was hooked, but carried away the gear, and then the vessel proceeded to Seattle without further attempts at fishing.

The three specimens were reported taken at a position of Lat. 52°–40′ N., Long. 134°–20′ W., or approximately 190 miles WNW of the position at which the "Mitkof" reported its specimen. The three fish taken by the "Brisk" weighed 16¾ pounds, 17¾ pounds, and 20½ pounds, and measured 27 inches, 28 inches, and 31 inches, to the caudal peduncle, respectively. Since the vessel was not equipped with a thermometer, no water temperatures were taken.—V. J. Samson, *United States Bureau of Fisheries, Seattle, Washington.*

Reviews and Comments

THE TETRAPOD REPTILES OF CEYLON VOLUME I. TESTUDINATES AND CROCODILIANS. By P. E. P. Deraniyagala. Colombo Museum, Ceylon, 1939: I-XXXII, 1–412, 137 figs., 24 pls. [Dulau and Co., London, 15 shillings].—Deraniyagala's studies on turtles, and especially his classification of the marine forms, has been called to the attention of American herpetologists by Clifford Pope, who has followed Deraniyagala's unfamiliar system in his recent *Turtles of the United States and Canada.* The appearance of Deraniyagala's volume now makes it easier to examine the basis for his proposals, which are, briefly, to distinguish two kinds of loggerhead turtle in the Pacific and Indian oceans as we do in the western Atlantic, and to arrange the resulting six species and subspecies of marine turtles in four monotypic genera. It may be stated at once that Deraniyagala's evidence is convincing as far as the species are concerned, and that the reviewer finds himself in agreement with Pope in following his arrangement until it is altered by renewed and more comprehensive studies.

Deraniyagala's present work assembles a large amount of new and important information about the turtles and crocodiles of Ceylon, but it suffers from a variety of major defects which are essentially editorial. Thus the large amount of space devoted to the gross embryology of the leatherback turtle and of the crocodiles might better have appeared elsewhere. Too much emphasis is placed on the definition of higher categories, suborders, superfamilies, and families, without the insight that the status of such higher groups is essentially arbitrary and variable, while the facts in question remain the same. This trend in the present work leads directly to generic splitting, with the establishment of an additional genus in the marine turtles and the setting up of a distinct genus for the salt water crocodile. Important new material is buried in a mass of detail on one hand and in a speculative framework of classification on the other, and this mixture of data and opinion of very unequal value pervades the work. The description of a new subspecies of fresh-water turtle, ***Melanochelys trijuga parkeri,*** for example, entirely fails to establish any geographic separation from ***M. t. thermalis,*** or to offer evidence of any ecological isolation. The paragraph on the origin of turtles in the southern hemisphere misses the whole argument of dispersal from Holarctic centers. The discussion of the size of the salt-water crocodile is unconvincing; the proportion of head length (to occiput) to total length is about one-seventh in crocodilians measured by the reviewer; it is quite likely that this proportion decreases in very large specimens, but a trend in this direction, which should certainly be discernible in specimens more than 12 feet long, remains to be demonstrated. The measurements of total lengths cited by Deraniyagala from the literature seem to be accepted uncritically.

Aside from a classification of the species problems in existing marine turtles, the principal merit of the present work lies in the presentation of information about the natural history of the turtles and crocodiles of Ceylon, summarized from previous reports and based on much new and interesting data. The account of the egg-laying habits of the leatherback turtle is especially noteworthy.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

THE ALLEGED PUGNACITY OF THE SWORDFISH AND THE SPEARFISHES AS SHOWN BY THEIR ATTACKS ON VESSELS. [A STUDY OF THEIR BEHAVIOR AND THE STRUCTURES WHICH MAKE POSSIBLE THESE ATTACKS.] By E. W. Gudger. Mem. Roy. Asiat. Soc. Bengal, 12, 1940: 215–315, pls. 1–9, figs. 1–22.—With his characteristically encyclopedic approach, Dr. Gudger has here monographed a subject of both scientific and popular interest. From all available sources of information, beginning with the earliest recorded attack in the New World and ending with statements which have recently come to his personal attention, the author has, as he writes, ferreted out and brought together in definite order, accounts of assaults on vessels by the xiphiid and istiophorid fishes. The accumulated testimony is classified

by geographic regions, by injury and death to seamen, and by the depth to which the sword has penetrated vessels. Supplementary data are given on the methods of the special fisheries by which these huge fishes are taken; on the use of their weapons in gaining food; on the size, weight and speed which they attain; and on the skeletal structures which make it possible for them to drive their rostrums deep into hardwood. The striking force of the fish is computed. Finally the author concludes that attacks on vessels on the high seas are incidental to the pursuit of such fish as albacore which seek the ships' shelter, and that wounded swordfish strike schooners and dories on the fishing grounds in undeliberate, defense reaction. He claims that *Xiphias* is a timid, not a pugnacious fish.—Carl L. Hubbs, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

A MANUAL OF AQUATIC PLANTS. By Norman C. Fassett. McGraw-Hill Book Co., New York and London, 1940: i-vii, 1–382, many figs. $4.00.—In its avowed aim to make possible the identification of aquatic plants in sterile as well as in flowering or fruiting condition this manual happily breaks a botanical precedent. General students of aquatic biology and wildlife managers, "from Minnesota to Missouri and eastward to the Atlantic," now have, for the first time, a ready and authoritative means for the identification of fresh-water plants, which are of enormous biological interest as well as economic value. The technical statements in the keys are thoroughly clarified, and the distinctions visualized, by a profusion of clear outline drawings. An appendix gives concentrated outlines on the Use of Aquatic Plants by Birds and Mammals and on The Relation of Plants to Fish. Fresh-water fishery biologists should be among those to profit most from the publication of this thoroughly usable yet comprehensive treatise. —Carl L. Hubbs, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

BIOLOGICAL DRAWINGS, WITH NOTES, PARTS I & II. By Maud Jepson. Chemical Publishing Company, New York: 1–57, $2.00.—A student's laboratory notebook, for a course in general biology, with a very extensive array of drawings, rather informally but well made and completely labelled. This book is intended to obviate the need of having students draw pictures in laboratory courses, and thus permit them to give some time to studying specimens, a method well worth trying, in the face of the desperate and rather hopeless efforts of the average college student.—L. A. Walford, *Stanford University, California.*

Ichthyologists, unfortunately, are not always very mathematically inclined, even though a great part of their work requires the analysis of measurements. For those wishing to enlarge their knowledge of statistical methods, the following should prove valuable:

HANDBOOK OF STATISTICAL MONOGRAPHS, TABLES, AND FORMULAS. By Jack W. Dunlap and Albert K. Kurtz. World Book Company. 1932: iii–vii, 1–163, 98 tables, $6.00.—This is a collection of monographs designed to provide a quick method, by eliminating calculation, of determining some common statistics, such as standard deviation, standard error, probable errors, standard error of estimate, etc. In addition, there are a number of tables, a remarkably comprehensive list of formulas, with references to books describing their uses, and a list of errors found in published formulas. This is a very useful handbook for the statistical library.

STATISTICAL DICTIONARY OF TERMS AND SYMBOLS. By Albert K. Kurtz and Harold A. Edgerton. John Wiley & Sons, Inc. 1939: v–xiii, 1–191, $2.00.—This book is intended to provide the user with "clear and accurate definitions of each of the various meanings of the statistical terms which he encounters in his reading of scientific literature." It fulfills that purpose very well. It does not substitute for a textbook of statistics, nor does it ordinarily give formulae for the calculations of statistics. It does, however, serve as an aid to intelligent reading of papers using statistical terms.—L. A. Walford, *Jordan Hall, Stanford University, California.*

Editorial Notes and News

G. K. Noble

DR. GLADWYN KINGSLEY NOBLE, eminent herpetologist and a leader in the field of experimental biology, died suddenly on December 9. Dr. Noble was born on September 20, 1894, at Yonkers, New York. He is survived by his wife, Ruth Crosby Noble, who collaborated with him in life history studies of frogs, and by two sons.

Dr. Noble graduated from Harvard in 1918, receiving his M.A. degree from this institution a year later, and in 1922 his Ph.D. degree from Columbia. He was appointed Research Assistant to the Department of Herpetology of the American Museum in 1917, then Assistant Curator and later Associate Curator, and in 1924 he became Curator of the departments of Herpetology and Experimental Biology. In 1931 he was visiting professor of zoology at the University of Chicago, in 1939 visiting professor of

biology at New York University, and at the time of his death was lecturer in herpetology at Columbia.

In 1914 Dr. Noble conducted an expedition to Guadeloupe and in 1916 was a member of another expedition to northern Peru, both sponsored by Harvard University. His search for data and for animals for his behavior studies took him to Santo Domingo, to western Cuba, and to many of the caves throughout the United States.

Under his direction the Department of Experimental Biology developed the most outstanding laboratory of its kind in the country. Many years of investigations in the laboratory resulted in the working out by Dr. Noble of the unique Hall of Animal Behavior in the American Museum, where for the first time museum exhibits attempt to reveal the mental life of familiar animals, based on psychological and physiological research.

Dr. Noble's scientific publications include such indispensable works as that on the osteology and thigh musculature of the Salientia and "The Biology of the Amphibia," and many other scientific papers on herpetology, ornithology, neurology, anatomy and phylogeny of the vertebrates, amphibian life histories, endocrinology and experimental morphology.

His personal attributes are best described by the words of his American Museum colleagues, who, in expressing their sorrow at his loss, wrote: "He combined unusual ability in his personal research, with phenomenal power to enlist and direct the investigations of others. The unlimited demands of his own work never prevented him from responding generously to the requests of his associates for critical advice."

Adolpho Lutz

DR ADOLPHO LUTZ, elected an honorary member of our Society in 1939, in recognition of his contributions to American herpetology, died at Rio de Janeiro on October 6, 1940. Dr. Lutz will be remembered by those of us who were fortunate to meet him and become his friends during his visit to the United States some years ago, for his gentle personality and his modesty, a modesty that gave no hint that as a pioneer in experimental medicine, he had fought tropical diseases with such courage and such success that he had become recognized as one of the outstanding American scientists of his day.

Dr. Lutz was born in Rio de Janeiro, December 18, 1855, of Swiss parents. He was educated in Berne, London (with Lister), Vienna, Prague, Leipzig (with Leuckart), and Hamburg (with Unna). Returning to Brazil in 1881, he took up the general practice of medicine in Sao Paulo, writing during this period several papers on hook worm. Later he was called to the leper colony on the Hawaiian Islands, where he met the volunteer English nurse who later became his wife. Here his researches in dermatology were continued and he made important contributions toward knowledge of the infectuous stages and the transmission of leprosy.

On his return to Brazil in 1892, Dr. Lutz was appointed Director of the Bacteriological Institute in Sao Paulo, which marks the real beginning of his work in public health. It was during this period that he established the identity of "Sao Paulo fever" with typhoid and began, almost singlehanded and against serious public opposition, a fight against yellow fever and bubonic plague and their carriers that practically eliminated these diseases in Brazil. He was the first to recognize the existence of a malarial mosquito which bred in bromeliads in forests where there was no standing water, and the first to apply the mosquito prophylaxis developed by Gorgas in Cuba. His publications at this time include papers on malaria and its carriage by mosquitoes, on haemogregarines of snakes, blood Sporozoa of birds, Microsporidia, and on Trypanosome infection of cattle. When, in 1908, Dr. Lutz left Sao Paulo to join the staff of the newly established Instituto Oswaldo Cruz, in Rio de Janeiro, the state of Sao Paulo commemorated his service by a medal struck in his honor, and three weeks after his death again honored him by naming the extensive new Institute, built in the grounds of his former modest laboratory and isolation hospital, Instituto Adolpho Lutz.

From 1908 to 1938 Dr. Lutz, as Director of Instituto Oswaldo Cruz, continued his contributions to the public health of Brazil. Traveling widely during this period, he made long journeys down the S. Francisco and Paraná rivers, to the Amazons, to the

northeast of Brazil, to Venezuela, where he was called to institute the teaching of tropical medicine and medical zoology. He worked on all the different groups of blood-sucking Diptera, on the parasites of man and other animals; from his study of amphibian parasites he became interested in the amphibians themselves and in their life histories, publishing papers on groups of *Leptodactylus, Bufo, Elosia, Cyclorhamphus* and Hylidae. In addition he did considerable work on crustaceans, mollusks and snakes. The Instituto Butantan was established at his instigation, to carry on the work he had started on snake venoms in his bacteriological laboratory.

Because of failing health, Dr. Lutz had directed the work of the Instituto Oswaldo Cruz, after 1938, from his home, where he continued his studies of Brazilian amphibians, in collaboration with his daughter, Bertha Lutz, Chief Naturalist of the Museu Nacional of Rio de Janeiro. One of his outstanding herpetological accomplishments was the assembling of water color drawings of the frogs of Brazil. It is to be hoped that Miss Lutz and Dr. Doris Cochran (who worked on Braziiian frogs with Dr. Lutz in 1935) will carry on to completion and make available to us these splendid pictures and Dr. Lutz's unfinished frog studies.

News Items

THE seventieth annual meeting of the AMERICAN FISHERIES SOCIETY, held at Toronto, Ontario, September 4, 5, and 6, was one of the most successful in the history of the Society, drawing a very large attendance and an unusually large contribution of reports and papers. The 72 papers presented at the Thursday and Friday sessions were grouped into the following categories: Commercial fisheries, fish culture and stocking, fish management, parasites and diseases, research studies, and miscellaneous topics. Unfortunately the program of papers was far too extensive for a 2-day session and many interesting papers were read by title only.

INDEX TO SCIENTIFIC NAMES
1940, Nos. 1-4

New names and their principal references are printed in bold face type

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